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ABSTRACT

The Recreational Boating and Fishing Foundation (RBFF) aims to increase participation in recreational boating and fishing and thereby increase public awareness, appreciation, and stewardship of aquatic natural resources. This document contains a summary and 11 commissioned papers from an RBFF workshop to create guidelines for best educational practices in fishing, boating, and aquatic stewardship programs. Following a preface by Bruce E. Matthews, the papers are: (1) "Fishing, Boating, and Aquatic Stewardship Education: Framework and Best Practices Recommendations" (Anthony J. Fedler); (2) "Best Practices for Curriculum, Teaching, and Evaluation Components of Aquatic Stewardship Education" (William F. Siemer); (3) "Elements of Effective Environmental Education Programs" (Julie A. Athman, Martha C. Monroe); (4) "The Right Tools for the Job: How Can Aquatic Resource Education Succeed in the Classroom?" (Rosanne W. Fortner); (5) "Guidelines for Best Practices in Aquatic, Fisheries, and Environmental Education" (Michaela Zint); (6) "Best Practices in Boater Safety Education" (Alan R. Graefe); (7) "Defining Best Practices in Boating, Fishing, and Stewardship Education: Challenges and Opportunities for Reaching Diverse Audiences" (Myron F. Floyd); (8) "An Overview of an Issue and Action Instruction Program for Stewardship Education" (Tom Marcinkowski); (9) "Outdoor and Risk Educational Practices" (Marni Goldenberg); (10) "Water-Based Outdoor Recreation and Persons with Disabilities" (Jo-Ellen Ross); (11) "Recommended Educational Practices for Youth Environmental Education from a 4-H Youth Development Perspective" (Kathleen E. Vos); and (12) "Best Practices in Marine and Coastal Science Education: Lessons Learned from a National Estuarine Research Reserve" (Janice D. McDonnell). (Contains references in each paper.) (SV)

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RECREATIONAL BOATING & FISHING FOUNDATION

DEFINING BEST PRACTICES IN BOATING, FISHING, AND STEWARDSHIP EDUCATION

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July 31, 2001

Prepared for the Recreational Boating and Fishing Foundation under Contract #RBFF-00-C-004

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Acknowledgements

This project is the result of the efforts of many individuals who have given freely of their time and expertise to provide advice, guidance, and constructive comments throughout the project. Kristen LaVine from the Recreational Boating and Fishing Foundation (RBFF) staff was invaluable in coordinating the Workshop and providing general logistical support for the project. Her presence will be missed, but we wish her well in sunny California.

The members of the RBFF's Education Task Force 2 conceived and designed the project. Their insight for including a diversity of perspectives on fishing, boating, and stewardship education by contributors, their valuable participation in the Workshop, and their continuous input throughout the project were greatly appreciated. Members of Task Force 2 included: Chair Mike O'Malley, Washington Department of Wildlife; Elaine Andrews, University of Wisconsin Cooperative Extension; Eleanor Bochenek, Rutgers University Institute of Marine and Coastal Sciences; Virgil Chambers, National Safe Boating Council; Mark Cole, Inner City Fishing Institute; Shari Dann, Michigan State University; Debbie Hall, Florida Department of Environmental Protection; Carl Richardson, Pennsylvania Fish and Boat Commission; and Rich Wehnes, Missouri Department of Conservation.

Shari Dann needs special mention for her insightful review of the papers in this compendium. Our discussions and her comments helped provide focus to the framework and best practice recommendations.

Writers of the background papers came through with excellent summaries of research and model programs under short time constraints. I greatly appreciate their efforts.

Finally, I give my heartfelt thanks to all Aquatic Education Workshop participants for the exciting experience of working with you in forging the guiding principles and best practice recommendations. Your professionalism, dedication, enthusiasm and humor carried us all in accomplishing the very difficult task of sorting through over 100 items, organizing them into cohesive areas, and distilling them into 65 recommendations.

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Preface

Workshop on Best Practices in Boating, Fishing And Aquatic Resources Education

Opening Remarks by Bruce E. Matthews Recreational Boating and Fishing Foundation

Thank you for your contributions in sharing your talents, expertise and enthusiasm with us. The Recreational Boating and Fishing Foundation's mission is to increase participation in fishing and boating as well as the stewardship of the aquatic and marine resources that support these activities—a sort of a three legged stool or platform, without any one of which the whole thing is unable to stand. We intend to accomplish our mission in a way that ensures that fishing and boating is done in a safe, responsible, inclusive and sustainable way—and driven by an environmental ethic that places the interests of the resource and the best traditions of boating and fishing above mere personal gain, self-gratification and individual needs. We intend to support the boating and fishing that keeps the long-term view in mind, perpetuating the resource and the tradition, bequeathing both a healthy natural world and a vibrant outdoors legacy to "seven generations hence." This is a tall order.

How do we propose to do that? And where do your efforts fit? Let me take a few minutes this morning to help set the stage and put your efforts into the critical perspective where they belong. Through this I hope to help build a context that links to our bigger picture and also challenges you, and all of us, to advance our common agenda of enabling educators to more effectively reach their boating, fishing and stewardship-related goals.

Where This Workshop Fits

You've been asked, based on your fields and areas of expertise, your research, experience and national reputation, to assist RBFF in setting forth guidelines for best practices in education related to boating, fishing and stewardship. You've been convened in order to further discuss what your work means in the context of how best to set these guidelines forth; and to reach consensus founded on common, research-based convictions about the best ways to achieve goals related to skills development, knowledge acquisition, attitude development and behavioral outcomes consistent with enabling Americans, **all** Americans, to learn to fish, boat and care for the resource in a safe, sustainable and responsible manner.

We want to enable our educators—boating safety instructors, aquatic educators, outdoor skills instructors, environmental educators, camp counselors, conservation educators, therapeutic recreation and adapted physical education specialists, whatever they're called and however they're known—to know and utilize the best practices in delivering education programs—practices based on research, and designed to provide the best possible means of attaining the skills, knowledge, attitudes and behavioral goals we seek to reach. And RBFF seeks to empower these same educators to offer these guidelines as evidence to the decision-makers and administrators for whom they work—and yes to the public as well—that best practices do exist; that they as educators are accountable for using them, and administrators and others ignore them at substantial risk.

RBFF is doing this because all too often these same educators find themselves on the low end of the food chain in their agencies, competing for funding and respect with more powerful and visible programs, programs that traditionally have more immediate and observable consequences than many education programs. The fact that investment in long-term educative approaches years ago may have, in fact, enabled these agencies to avoid some of the public involvement participation and perception nightmares that currently besiege them still seems not to have registered with some. Education is viewed as "soft," perhaps not even science-based, which is the kiss of death in natural resource agencies priding themselves on using "professional, science-based approaches to wildlife management." Many agencies have only a vague idea of what education is, what it can do, and the differences be-

tween education, information, outreach, marketing and other related arenas. A recent program at an AFS symposium, by Judy Stokes, NH's highly capable I&E Chief, was entitled "Outreach and Education Partnerships in the Workplace: Or, I won't manage fish in my spare time if you won't manage outreach and education programs in yours". Judy hits the nail on the head. It's time that "good" education be validated in these agencies, and recognized as applying science-based practices as well. It"s time that education takes its appropriate place as a critical element in natural resources management. This workshop will help make that happen.

A recent report on NPR discussed the difficulties of educating kids in what's being called the "information age." There's so much information available, with so many groups using many new venues to get the information out, there is no way to assimilate or consume it all. Information overload is a commonly used term. And anyone trying to compete for consumer attention in this marketplace had better do their research and develop extremely effective messages or they will likely remain unheard.

How can we help people become more effective information consumers? And how can we help our resource agency stakeholders go beyond simply trying to deliver information, to see how using well-designed and research-based education efforts—utilizing best practices—will help them achieve their missions?

One way to approach this is to consider what the learner ought to look like after being educated. They need to have the skills and cognitive gateways necessary to sort and categorize information in terms of usefulness, quality, context, relativity. They need to be able to use information to build knowledge, and to understand the importance of using knowledge to support and provide a rationale for attitudes and behavior. They need to have the critical thinking, judgment and decision-making skills to be able to identify and use good information. They need to understand **how** to participate in the system—both natural systems and government processes. They need to know **how** to influence positive change, and they need to feel like they can make a difference with their informed participation, and through their actions.

Natural resource agencies who view as part of their mission to enable informed citizens to participate as partners in management—and I would argue that herein lies the future—must become part of the community—the village if you will—that seeks to support the lifelong education of its citizens.

Many groups view information as a product, and seek to deliver it to information consumers. Carried in one direction that information forms a message designed to influence consumer behaviors, and becomes part of a marketing strategy. Some confuse this with education, and believe that simply using marketing approaches will build boaters and anglers and environmental stewards. Marketing is critical in this process, for it creates awareness of opportunities to participate, positions participation and stewardship as top-of-mind, and influences and supports participation through social awareness, support and the "coolness" factor. But using marketing without education will ultimately fail. When the advertising stops, after our 3.8 carefully marketed media impressions have been delivered, when consumer attention is diverted, what will be there to sustain and support interest? Without education programs we'll have achieved little of lasting value. That's why what you're about to do is so important.

Increasing participation in recreational fishing and boating, and boosting "public awareness and appreciation of the need for protecting, conserving, and restoring this nation's aquatic natural resources," requires an integrated strategy involving both education and marketing approaches. To accomplish RBFF's stated mission an informed, integrated and coordinated effort is needed, guided by research and best practices in both marketing and education.

I'm pleased this morning to be sharing with you some of the marketing elements that have received our priority attention over the last nine months. They are culminating this evening with the first public launch of our TV ad—an event we intend not to go unnoticed, or more to the point uncelebrated! I hope you'll join us this evening to properly celebrate the first airing of our commercial, and to salute those responsible for making it happen.

Our market research indicated that our best target for early and measurable impact—the lowest hanging fruit—would be those who have participated in fishing and boating fairly recently, in the last five years or so, but did not go last year. They are the "lapsed" or "occasional" boater and angler who increasingly found it difficult to find time to go. They are most likely to be male, aged 30-54, with families and extended families. We've tried to position fishing and boating in our advertising as the activity of choice for reconnecting with your family. We tried to "brand" the experience of fishing and boating—the good things that happen when you fish and boat together—under the brand banner, Water Works Wonders.

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We think we're hitting our initial target audience where they live. And we'll be measuring the impacts of this ad, and combining this information with new research into how best to reach African-Americans, Hispanic-Americans, and how to intervene to moderate the severe participation drop-offs that occur at ages 16, and again after 45. We're also conducting original research in the lifestyles arena to better understand, and thus reach, potential audiences with fishing, boating and stewardship messages, using a context other than simple demographics or race. We'll be using this new research to drive decisions about specific target audiences in the next phases of the ad campaign, in 2002 and 2003.

The duality of this approach—recruiting participants as well as building them into resource stewards—using marketing as well as education strategies—is part of the genius in RBFF's strategic plan. Clearly, a goal of simply adding more resource users will put more pressure on the resource, and ultimately will work against RBFF's mission through decreasing the quality of the experience and diminishing the aquatic resource itself. Without taking steps to ensure that these users behave in a safe, responsible, ethical and sustainable manner, a simple goal of increasing participation is ultimately doomed, especially over the long term.

Similarly, relying primarily or exclusively on marketing efforts to get the recruitment job done will certainly increase awareness and probably initial participation in fishing and boating. But without the critical elements brought to bear through education efforts, simply marketing, to use a Biblical reference, will be like seed sewn on thin soil. It will sprout but soon wither for lack of the nourishment needed to grow. Education is required to make fishing and boating rich and deep and "sticky" –to enable it to grow and flourish over the long term—particularly to the point where it builds stewardship.

One way to envision RBFF's mission accomplished, to extend the analogy, is to see the results of the seed falling on good ground—the use of best practices in marketing and education, guided by evaluation and research outcomes. This seed grows into committed anglers and boaters—avid participants who mature and eventually reach the point of giving something back—to the resource and to the traditions they have come to cherish. Fishing and boating are fundamental to their definitions of who they are. "I fish, therefore I am" is more than a t-shirt slogan, it's a statement of being. These individuals are regular and loyal customers, resource advocates, lifetime license buyers, conservation leaders, and environmental stewards. The fruit thus brought forth bears its own seed, passing on boating and fishing traditions, and a stewardship ethic, to the next generation.

I hope this effectively sets the stage for the important work you are in the midst of undertaking. Your efforts today and tomorrow will provide the foundation built on rock, on firm ground, not on sand—and yes, it is after all Sunday morning. Praise the Lord! It will then be up to us to disseminate, communicate and secure buy-in for these best practices among our various stakeholders, and help train them to assure their understanding and use.

I thank you for your work, your dedication, your shared commitment to the values of participation and stewardship of our resources. I have looked forward to this day for a long time. Thank you for making it possible.

Fishing, Boating and Aquatic Stewardship Education: Framework and Best Practices Recommendations

Anthony J. Fedler
Human Dimensions Consulting

Abstract – Increasing questions about value and efficacy of aquatic and boating education programs have spurred the call for scientifically based guidance for improving and evaluating those programs. The recreational Boating and Fishing Foundation has responded to this call with the *Best Practices in Boating, Fishing and Stewardship Education Project*. A group of eleven aquatic, environmental and outdoor education professionals were commissioned to provide summaries of research and recommendations for the development of best professional practices for fishing, boating and aquatic stewardship education. Twenty-five researchers and educators then reviewed the research and recommendations during a workshop. They compiled, and agreed upon, guiding principles and specific best practice recommendations for planning, designing, implementing, and evaluating aquatic and stewardship education programs. Additionally, the workshop group made recommendations for improving aquatic education research. This paper summarizes the process involved in completing the project, develops the conceptual framework within which to consider the principles and recommendations, outlines the principles and best practice recommendations, and provides an overview of each background paper written by experts in aquatic, environmental, and outdoor education related fields.

Project Background

In 1998, the Department of Interior's Sport Fishing and Boating Partnership Advisory Council completed a strategic plan for their Outreach and Communication Program. The initiative sought to increase participation in fishing and boating to complement ongoing conservation efforts by government agencies, and to pass on these American traditions and a legacy of stewardship. The Recreational Boating and Fishing Foundation (RBFF), whose mission is to increase participation in recreational angling and boating and thereby increase public awareness and appreciation of the need for protecting, conserving and restoring this nation's aquatic natural resources, was created to carry out this initiative.

RBFF's directive provides the impetus for delving into the aquatic education arena. A primary thrust of the RBFF is to advance an agenda of enabling outdoor educators to access guidelines for best practices in delivering fishing, boating, and stewardship education programs. Accomplishing this mission in a way that ensures that fishing and boating is done in a safe, responsible, inclusive and sustainable way—and driven by an environmental ethic that places the interests of the resource and the best traditions of boating and fishing above mere personal gain, self-gratification and individual need—requires strong educational support, and a grounding in research-based best practices. The objective is to develop and sustain the type of boating and fishing that keeps the long-term view in mind, perpetuates the resource and the tradition, and bequeaths both healthy aquatic resources and a vibrant outdoors legacy to future generations.

Task Force Two – The Education Task Force

Widespread recognition of the absence of formal evaluations and related research to guide aquatic resource and aquatic educator manifested itself as a priority concern at the initial February 2000 meeting of the Recreational Boating and Fishing Foundation's (RBFF) Education Task Force (TF2). The task force addressed the educational component of the Sport Fishing and Boating Partnership Council's Outreach and Communication Program Strategic Plan. The Education Task Force defined an ambitious agenda to its charge: Determine the best ways to "Educate people about how and where to fish and boat." To begin, the task force defined recreational boating, fishing and stewardship education as:

> "A complex process by which related skills, attitudes, knowledge, and behaviors are enhanced, developed and supported through a planned series of experiences.

The education task force also determined who the primary and secondary audiences are for the work of the task force:

- Primary Audiences
  1. Aquatic educators

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2. Education service providers – including their supervisors and administrators
3. Agency educators – formal and non-formal, including agricultural extension and parks and recreation departments
4. Education brokers – organizations responsible for providing education services.

- Secondary Audiences
  1. Task Force 4
  2. Point of sale – state license processing agencies
  3. Partners
  4. Wildlife law enforcement officers
  5. Non-governmental organizations that provide education programs
  6. Community-based organizations that provide education programs

Identifying what already exists was the next step identified by the Education Task Force. A request for proposals was issued to begin an inventory, database, and directory of existing educational programs, events, and curricula. The database is a directory for stakeholders where they can locate appropriate programs in their field of interest or in a particular geographical location. A contractor was selected and a website developed to build, maintain, and update the database. The website can be found at http://www.rbff-education.org.

The Education Task Force also included in its initial plans the need to determine which processes provide the best experiences for conveying knowledge, developing skills, and changing attitudes and behaviors from the following fields: community-based education, traditional education, experiential education, outcome-based education and evaluation, drug prevention education, watershed education, environmental ethics education, outdoor/adventure education, risk education, intervention, therapeutic recreation, sport sociology, leisure education, and non-formal education. To that end, they suggested that the RBFF issue a request for proposals to compile the best professional practices to provide guidance to boating, fishing, and stewardship educators.

The Education Task Force also included in their overall strategy to "Educate people about how and where to fish and boat" a review of the relationship between boating and fishing participation and stewardship attitudes and behaviors. This literature review will provide the background for a future longitudinal research project that examines significant life experiences and their role in stewardship attitude and behavior development.

Within this context, an educational framework must be built that links aquatic education to the broader natural resource management picture. The objective is to enable educators—boating safety instructors, aquatic educators, outdoor skills instructors, environmental educators, classroom teachers, youth program volunteers, camp counselors, conservation educators, therapeutic recreation and adapted physical education specialists—to know and utilize the best practices for delivering outdoor education programs. Just as we base habitat and population management on research, educational practices also must be based on research and designed to provide the best possible means of attaining the skill, knowledge, attitude and behavioral goals we seek to reach. The Best Practices Project seeks to empower these same educators by offering guidelines as evidence to the decision-makers, administrators and public for whom they work that best practices do exist and that they as educators are accountable for using them.

Each year, millions of young people and adults are involved in fishing, boating and aquatic stewardship education programs. Staff and fiscal resources being devoted to these programs are receiving increased scrutiny as the effectiveness and value of these programs are questioned, particularly during difficult budget years. At issue are the benefits of boating, fishing, and stewardship education programs to state and federal fish, wildlife, and boating-related agencies and organizations. As budgets become more constrained, justification for each agency or organization program becomes more important. Biologists can point to improved water quality, miles of streams or acres of lakes rehabilitated, increased fish populations, and the larger size of fish as measures of biological benefits.

For educational programs, outputs like the number of children, adults or families participating in an educational program or event often serve as the only measures of program performance. Does participation in these programs contribute to agency revenues, image, or overall mission? Do educational programs result in more fishing licenses being sold? Do they result in a greater stewardship ethic and aquatic resource advocates among participants? Do they result in stronger support for the agency, its programs, and its budget? Administrators and program staff both recognize that there are many other goals associated with fishing, boating, and stewardship education programs, but there is little direct evidence that these goals and their related objectives are being achieved.

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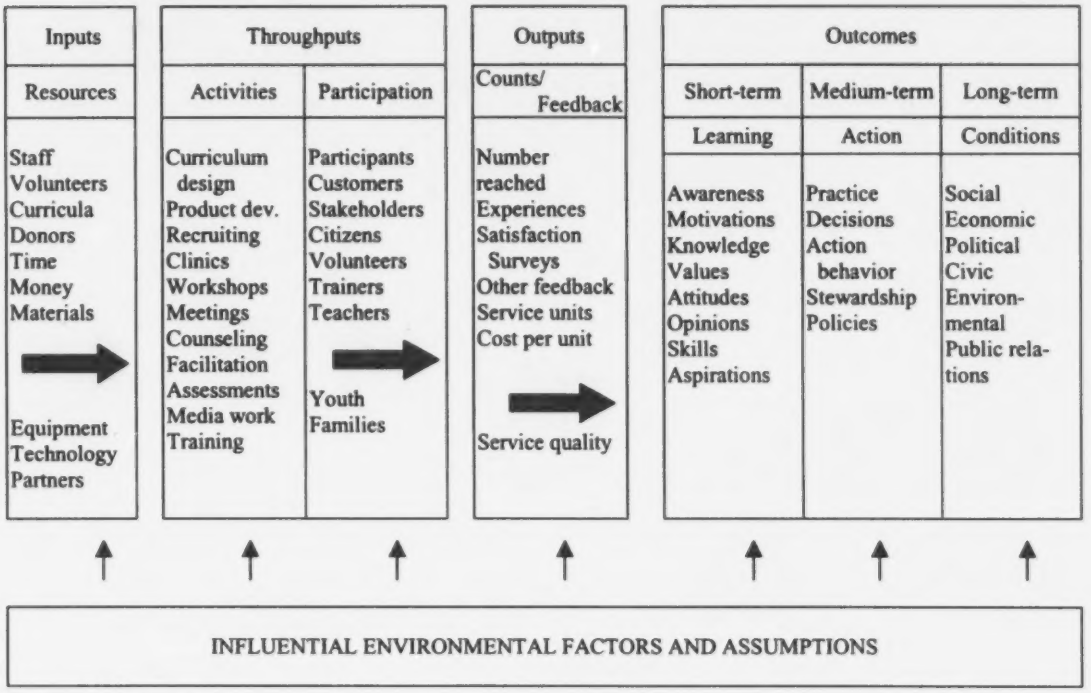
Figure 1: Conceptual Model for Program Development and Evaluation in Boating, Fishing and Aquatic Stewardship Education



Aquatic education goals can focus on short-term outcomes like facilitating change in awareness, knowledge, skills, or attitudes of participants. They can also address longer-term impacts such as changing individual conservation-related practices, decisions and behavior, or improving societal, economic or environmental conditions. Measuring the attainment of these goals is often difficult and may require expertise in sociological, psychological and educational research often unavailable in most agencies. However, to be accountable for their programs, education specialists need to be proactive and use appropriate evaluation tools and methods to measure intended outcomes and impacts. Furthermore, programs need to be designed based on the best information research and practical experience has to offer. This same information should be used to evaluate the quality of existing programs. Recommendations developed from research and practice that has been shown to be effective are often referred to as "best practices." Best practices can fill the needs of educators until more formal program evaluations can be conducted.

Conceptual Model for Best Practices

Applying best practices to aquatic and stewardship education programs requires an understanding of the outcomes desired from the program, appropriate methods for achieving the outcomes, resources necessary to apply the methods, and the environment and setting in which the program will occur. In essence, a systems approach can be applied to any program-planning endeavor to understand the linkages among components and to be able to evaluate the program (Rush and Ogborne 1991). The ability to link program activities to specific learning outcomes and then to longer-term impacts has led to what is called program theory (Rossi et al. 1999, Wholey 1987). Program theory provides the framework for describing how different factors (events, persons, functions and other elements of the program)

are related. Generally, these factors may be viewed as having cause-effect relationships (Funnell 1997, Julian et al. 1995). The elements and relationships for a given program can be depicted graphically in what has commonly been referred to as a program logic model. Besides serving as a communications device, program logic models can be used as heuristic devices to encourage a variety of questions concerning program design, implementation and evaluation (Rossi et al. 1999, Coffman 1999). For example, are program goals and objectives well defined and feasible? Are the individual components, activities and functions of the program well defined and sufficient? Is the change process articulated in the program theory plausible and achievable? Moreover, logic models can play an integral role in formative (ongoing during the program) and summative (conducted after completion) program evaluations. By understanding program components and their relationship to desired outcomes, each link in the process can be identified and evaluated.

A general conceptual model that can be applied to aquatic education is shown in Figure 1. There are four major components of the model, inputs, throughputs, outputs and outcomes. These arise from an existing situation or need and are influenced by the existing environment and any assumptions associated with the program. Environmental factors, which can influence the development, implementation and success of the initiative, include politics, climate, socio-economic conditions, institutional constraints, and other factors. The ability to identify, control or mitigate influential environmental factors, and the costs of doing so, are crucial to successful program development, implementation and evaluation.

The conceptual model shows the inputs or resources an agency or organization invests in order for a given initiative or program to occur. Inputs include staff, money, equipment, facilities, and other resources needed to carry out the program such as administrative approvals, budget authority, and agreements with cooperating agencies and organizations. The model links these resources to specific activities designed for target audiences. Activities and their participants are viewed as through-puts. The term "participants" is not limited to educational program learners but should include staff, administrators and others who are themselves learners in training programs and educational briefing sessions.

Once activities are completed, initial outputs are observed and measured. In the past, outputs often have been the sole measure of program effect. Programs or initiatives often focus only on how many people attended, on how many were reached or exposed to a message, or on how satisfied participants were with their experience. These measures are useful if the objectives of the program are to provide satisfying experiences for the participants or to convey information to the public. But, aquatic and stewardship education specifically, and environmental education generally, need to focus beyond outputs to short- and long-term outcomes to increase environmental awareness and knowledge, change attitudes and opinions, and establish an ethics-based valuing system that will later serve as a foundation for responsible behavior toward the environment in a variety of situations that one experiences. Achieving short-term or the lasting impacts of higher-level behavioral and societal changes are impossible to measure without carefully planned programs with commensurate rigorous evaluation activities.

Thus, logic models can provide a conceptual map for program design and evaluation purposes. In fully explicated program logic models, such as Dr. Tom Marcinkowski presents later in this document, it is possible to:

- Summarize the key elements of your program;
- Explain the rationale behind program activities;
- Clarify the relationships between activities and the intended outcomes of the program;
- Show the cause-and-effect relationships among activities and outcomes – that is, which activities are expected to lead to which outcomes;
- Help identify the critical questions for improving program design and evaluation; and
- Provide the opportunity for program stakeholders to discuss the program and agree upon its description.

When designing a new program or evaluating an existing program, this conceptual model and specific program logic models can be particularly helpful when using best practices for guidance.

A "best practice" can be defined as a program or practice that has been clearly defined, refined through repeated delivery, and supported by a substantial body of research.

These practices represent the best knowledge available for use under certain circumstances. Best practices are not immutable. They are recommendations based on what has been observed to be effective, but which may change given additional experience, evaluation, and research. Within natural resource management agencies,

best educational practices should be recognized as applying science-based practices similar to those applied to fisheries, wildlife and natural resource management.

Identifying Best Practices

An approach to developing best practices is to consider what we want the learner to "be able to do, or be like" after being educated. Learners will have the physical skills necessary for successful participation in boating and fishing activities. They will have the intellectual skills and cognitive gateways necessary to sort and categorize information in terms of usefulness, quality, context, and relativity. They will have the ability to use information to build knowledge, and to understand the importance of using knowledge to support and provide a rationale for their attitudes and behavior. They will have developed the critical thinking, judgment and decision-making skills to be able to identify, use, and act appropriately on good information. They will have become ethically competent and fit. They will understand how to participate in both natural systems and government processes. They will know how to influence positive change and feel like they can make a difference with their informed participation, and through their actions.

Educational programs designed to change and encourage aquatic resource conservation and stewardship behavior also should consider the social context surrounding relevant environmental issues (Laska 1990). The literature on character, morals, ethics, and values education clearly establishes the importance of understanding the influence of social context on the success of educational efforts (Leming 1993a, 1993b; Matthews and Riley 1995). If not grounded within the particular community and cultural context of the learner, aquatic and environmental education will remain abstract, outside the scope of experience of the learner, inconsistent with cultural norms, and ultimately irrelevant (Berger and Neuhaus 1977, Hauerwas 1981, Sichel 1988).

Belonging to and identifying with a group is important for an individual's personal development. Researchers have identified social group and community as important variables in the development of ethics and values (Hauerwas 1981, Sichel 1988). Group and community members positively influence or actually initiate an individual into activities like fishing and boating, and can encourage or discourage participation and stewardship behaviors associated with aquatic resources (Dann 1998). Thus, aquatic education programs will be most effective in reaching behavioral goals if designed to incorporate parents, family, and neighborhood as part of the learning community (Matthews and Riley 1995).

Given the absence of research and evaluation literature to guide boating, fishing and aquatic stewardship education program development in the attainment of these lofty goals, we must turn to using best professional practices by drawing upon the diverse and rich research literature and practical experience from related fields. Identifying widely accepted principles and standards for education can provide the guidance needed until relevant directed evaluations have been conducted that indicate a different or more effective approach could be taken. These best practices can be used for planning, developing and implementing programs, providing ongoing professional development, conducting program evaluations, and identifying relevant research to further understand and improve the educational process.

The Best Practices Project

The Best Practices in Boating, Fishing and Stewardship Education Project focuses on identifying accepted principles and standards generally applicable to boating, fishing and stewardship education. Eleven experts with research and practical experience from diverse fields made recommendations for best educational practices for curricula, programs, and leadership that would affect change in aquatic resource and environmental knowledge, attitudes, and behaviors. Recommendations were to be supported with scientific research, peer recommendations, and practical experience. Each expert wrote a review paper distilling the best professional practices from his or her field that would likely result in accomplishing the goals of boating, fishing, and stewardship education programs. The experts also wrote a brief overview of appropriate evaluation methods for gauging the effectiveness of boating, fishing, and stewardship education programs. Gaps in the literature, pertaining to understanding the effectiveness of different educational approaches, were identified and prioritized as future research needs.

Experts were selected from fields such as:

- Boating education
- Aquatic education
- Environmental education
- Marine education
- Youth development
- Stewardship and environmental ethics education
- Adventure recreation education
- Minority education, and
- Outdoor education for people with disabilities.

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Table 1: Guiding Principles for Boating, Fishing, and Aquatic Stewardship Education

Boating, Fishing, and Stewardship Education:

- Is learner-centered.
- Constitutes a continuous and lifelong process for individuals, families, and diverse social groups.
- Considers aquatic resources in their totality, including natural, built, technological, and social aspects (e.g., economics, politics, cultural-historical, moral, aesthetic).
- Provides participants with opportunities to engage in the valuing process (i.e., choosing, affirming, acting) as it relates to programs, program activities, and their own growth and development.
- Follows the principles of inclusion with regard to program participation by minorities and people with disabilities.
- Begins with goals and objectives that relate to appreciation and awareness, expand to include both knowledge and skills, and culminate in personal responsibility and responsible behavior.
- Builds upon local, state, and national partnerships to support the development, implementation, and evaluation of programs, as well as to support stewardship of the resource.
- Relies on a variety of systematic and continuous approaches to the assessment of participants and evaluation of programs so as to improve and eventually validate those programs.
- Supports, engages in, and makes use of the scientific, social, educational, and other forms of research that have a bearing on programs.
- Recognizes the critical role and the need to adequately support ongoing professional development for all personnel associated with these efforts and programs, including those suggested or implied in the above principles.

After completing their papers, the experts were joined by several professional boating, fishing and aquatic education administrators and practitioners in a workshop designed to reach consensus on basic principles and best practices derived from the collection of written papers and the group's collective practical experience. During the workshop, participants identified 10 general guiding principles for education programs. Additionally, the group recommended basic practices for each of four educational areas: 17 for program planning, development and implementation; 21 for professional development; 11 for program evaluation; and 6 for educational program research. Each of the principles and recommendations can be used in forming components of new programs or in evaluating existing programs.

Guiding Principles

Workshop participants identified Guiding Principles to provide the general framework and considerations necessary to successfully plan, develop, implement, and evaluate fishing, boating and stewardship education programs (Table 1). Chief among these principles is that education programs should be learner-centered and provide a lifelong process for individuals, families, and diverse social groups. Programs should meet the educational needs of the learners. Program designers should consider different learning capacities, cultural backgrounds, and special learning needs. And importantly, program designers should follow the principles of inclusion with regard to program participation by minorities and people with disabilities.

Boating, fishing and aquatic stewardship education programs need to encompass aquatic resources in their totality. Focusing on the natural component to the exclusion of the effects of development, technology, economics, politics, and other related factors reduces perspective on problems and ignores the complexity in solving environmental problems and managing natural resources.

The goals and objectives of educational initiatives should reflect a progression that begins with an appreciation and awareness of aquatic environments, expands to include the acquisition of knowledge and the development of skills for interacting with that environment, and culminates in ascription of personal responsibility to the care of aquatic resources and responsible behavior toward them. Within this context, participants should have the opportunity to engage in the valuing process by choosing information that is relevant to them, affirming it within their own belief and attitude structure, and using that structure to guide their actions toward the environment.

Agencies and organizations often fail challenges in effectively and efficiently developing and maintaining aquatic education programs over time. These challenges include changes in staffing and budget priorities. Thus, many successful programs are cooperative ventures with partnerships to support program development, implementation, and evaluation. This success is also predicated upon support for ongoing professional development for all personnel involved in all aspects of the program from administrators and trainers, to instructors and volunteers.

Finally, programs should rely on a variety of systematic and continuous approaches to participant assessment and program evaluation at all levels to improve quality and to eventually validate the program model. The conceptual model presented earlier and specific program logic models can provide the framework for conducting assessments of participant needs and capabilities. It can also identify the linkages among program elements that need evaluation to ensure that curricula are meeting outcome objectives. This implies that relevant scientific, social, educational, and other forms of research are used in the planning, design, implementation, and evaluation of aquatic education programs and that needed research is supported by the agency, administrators, and program personnel.

Recommendations for Best Practices

Workshop participants, comprised of both practitioners and academicians, used the papers prepared by the writers, their own personal knowledge of the literature, and their professional experience to organize recommendations for best practices into four categories: program development and implementation, professional development, program evaluation, and educational research. These categories emerged from the initial program framework articulated by the group that later evolved into the conceptual model in Figure 1. Other categories may emerge after further review and study by environmental professionals. Additional recommendations for each category are also likely to surface. The recommendations below should neither be viewed as exhaustive nor complete. After further review and application, some recommendations may need modification or additional clarification. As a result, this best practices work will need to continue into the future.

This is a beginning point from which professional experience, program evaluation, and educational research should continually challenge the reality of each recommendation. Best practices should evolve over time as we learn more about how our programs affect knowledge, skills, attitudes, and behaviors. Without commitment to formative and summative evaluations and without commitment to basic educational research to fill existing knowledge gaps and extend our current understanding, we will not develop an expanded scientific basis to improve and extend practices that lead to efficient and effective educational programs.

Each recommendation is presented within the context of characteristics of effective programs. Programs that embody these characteristics should be effective and, thus, capable of meeting their objectives.

Program Development and Implementation

Best practice recommendations for program development and implementation (Table 2) focus on learner, curriculum, and agency needs. Programs should be accessible to all learners and employ adaptive technology and strategies for inclusion. Curricula need to be developmentally appropriate and designers should consider age, gender, ethnicity, and socioeconomic status. Programs should equip learners with skills to participate more competently in fishing and boating activities. They should equip them with skills to analyze and evaluate information and issues and to develop the personal and civic responsibility necessary to become active resource stewards.

Curriculum development should begin with a needs assessment; during this step, programmers should profile program participant characteristics and also identify the needs of the agency and local community as well. Coupled with a needs assessment should be an inventory of administrative, educational, community, and environmental resources that can be used to shape individual programs. Programs should utilize teaching methods that are appropriate for program goals and objectives, and be sensitive to participant needs. Information should be interdisciplinary and accurate, and presented in a fair and balanced manner that includes all points of view on controversial issues. Materials used should be evaluated for factual accuracy and balance as well. Programs should be learner-centered and allow for active and experiential learning opportunities.

There should be firm agency commitment behind each program. This means that the program is relevant to agency goals and objectives and that adequate and sustainable resources are available. It means that the agency is willing to involve stakeholders in the

Table 2: Best Practices for Program Development and Implementation

Effective Programs:

- Are relevant to the mission of the agency or organization sponsoring the program, the educational objectives of the audience, and everyday life of the learner.
- Use some form of needs assessment to establish a basis for and to help shape individual programs. Assessments should include needs of the agency, community, and participants.
- Involve stakeholders at all levels of their development.
- Empower learners with skills to address environmental issues and with a sense of personal and civic responsibility.
- Present accurate and balanced information incorporating multiple perspectives using an interdisciplinary approach.
- Are accessible to persons with disabilities and incorporate adaptive technology, support staff, and services to meet the needs of all participants in an inclusive manner.
- Receive adequate resources, staffing, and are supported through appropriate resources and staff so that they become sustainable over time.
- Are instructionally sound, utilizing learner-centered and experiential instructional approaches to provide opportunities for collaborative learning and the development of critical thinking skills.
- Are developmentally appropriate, using multiple methods to enhance learning opportunities for diverse learning styles.
- Provide educational opportunities that are frequent and sustained over time.
- Use an interdisciplinary approach to develop skills, formulate concepts, and examine issues.
- Aligns curriculum with national and state educational standards, when appropriate.
- Use curricular materials and other print and electronic resources that present accurate information, and when addressing controversial topics, expose participants to different perspectives in a fair and balanced manner.
- Inventory and utilize a variety of educational resources and environments, including community resources (e.g., speakers, offices), and lab and field sites (e.g., hatcheries, marinas, ponds and lakes), in a sustainable manner.
- Are planned and carried out in a manner that clearly addresses safety and other regulations, and reduces real risks to everyone involved by utilizing professional safety and risk management techniques.
- Rely on experienced, well informed, prepared, and ethical staff to develop, implement, and evaluate programs.
- Make use of a variety of teaching and learning methods that are appropriate for a program's goals, objectives and subject matter, and are sensitive to participant age, developmental level, and background.

program and develop partnerships with interested agencies, groups and individuals, where appropriate. It also connotes that well-trained and prepared staff and volunteers are available and involved. Inherent in agency commitment is a genuine concern for participant and staff safety with regard to the program, facilities, and related services and that each aspect of the program has been reviewed and concerns addressed.

Professional Development

One of the key ingredients to any successful program is having highly qualified and well-trained staff and/or volunteers to provide leadership and work effectively with learners. Thus, best practices for program staff (Table 3) revolve around ongoing professional development and support, which are critical to sustaining effective programs over time. The cornerstone of professional development is recruitment of qualified and motivated program personnel. Whether hired staff or volunteer, knowledgeable, committed, and ethical individuals capable of working with diverse groups are important keys to success. Everyone associated with the program must have a clear understanding of agency goals and objectives and how they relate to agency educational programs.

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Table 3: Best Practices for Professional Development

Effective professional development:

- Clearly presents the agency's or organization's mission and goals.
- Inspires active, ongoing, lifelong learning by professional educators.
- Addresses diverse learning styles by presenting material in a variety of formats and experiences, and incorporates active learning.
- Values diversity and relates to audiences consisting of diverse social, cultural, and economic groups.
- Includes opportunities for youth leadership development as well as for adults.
- Includes aquatic resource stewardship as an outcome and/or longer-term impact.
- Follows a validated process for workshop training to establish consistency, when appropriate.
- Offers tiers of training to provide for continuing education using a "roll out" process for increasing learner knowledge and competency over time.
- Includes presentation of effective teaching methods and ways to foster learning.
- Presents models of good instructional and assessment practices.
- Provides opportunities for learning to continue over an extended period through the innovative use of the Internet, listservers, newsletters and networking.
- Provides mechanisms for updating existing information and disseminating it to educators and administrators.
- Uses attractive and appropriate training materials, and provide hands-on exposure to materials to be used in the classroom.
- Provides appropriate models of program evaluation.
- Considers audience motivations for participating in professional development (e.g., mandatory or voluntary).
- Includes formative, summative and long-term evaluation of the trainer, the program and the trainee.
- Includes pre-service (basic training) and in-service (in-depth) training modules and avoids brief one-shot training sessions.
- Recruits instructors with experience and knowledge in the subject area.
- Incorporates educational theory into training curriculum.
- Screens instructors, with criminal background checks, and interviews them for potential, motivation, commitment, ethical behavior, knowledge, and the ability to work diverse groups.
- Provide opportunities for mentoring by experienced instructors and staff.

Training should include basic pre-service orientation and exposure to program materials, processes, and mechanics. There should be additional in-service training where instructors can receive in-depth exposure to specific program elements or to new curriculum areas that will be integrated into the program in the future. Opportunities for continuing education should be encouraged, facilitated, and supported. This support includes opportunities to review and update program materials. Such reviews should be part of a validated process for training programs based on evaluations of trainer, program, and trainee. This will ensure program integrity across instructors and that desired outcomes are being achieved.

Professional development programs should be built on sound instructional models that recognize the diversity inherent in any group of learners. They should utilize multiple methods for presenting information and should incorporate active learning opportunities. These programs should use attractive and appropriate training materials and provide hands-on exposure to program materials. Training program design should reflect tiers of learning appropriate for the beginning teacher or volunteer as well as the master teacher. Training programs should also include opportunities for youth leadership development and mentoring at all age and experience levels. Above all, professional development should help inspire active, lifelong learning by professional educators and by volunteers, as well.

Program Evaluation

One of the most neglected components of educational programs is evaluation. Terms such as essential, valuable and mandatory have been used to describe the importance of evaluation, however, most evaluative efforts rarely report more than program outputs such as the number of participants, participant satisfaction, or

Table 4: Best Practices for Program Evaluation

Effective program evaluation:

- Is envisioned and undertaken as a systematic and ongoing process that begins when a program is being planned or developed, and that included both formative and summative evaluations.
- Receives both administrative support and budgeted allocations as part of program costs.
- Is utilized as a learning tool to support program reflection, decision-making, and improvement.
- Includes pre-assessments of learners and assessments of learning outcomes that are based on program goals and objectives.
- Helps identify program outputs, such as number of participants and participation feedback.
- Is used to help align program inputs (e.g., materials, resources) and processes (e.g., activities, services) with program outcomes.
- Explores and investigates the program's long-term benefits and impacts.
- Encourages the use of assessment methods that include, when appropriate, informal methods (e.g., Q&A, observations), traditional methods (e.g., quizzes, tests), and alternative/authentic methods (e.g., rubrics for performance tasks and projects, portfolios).
- Makes use of curricular materials that have been carefully reviewed against national criteria, or will use these criteria to select, develop and/or revise materials.
- Makes use of evaluators and evaluation methods that involve and empower program staff.
- Allows program staff (i.e., administrators, coordinators, and instructors) to take advantage of professional development opportunities in the areas of assessment and evaluation, so that staff have greater capacity to carry out and use results from sound program evaluations.

information exposure. Evaluations of short- and long-term impacts of aquatic education have been relatively rare, as have evaluations of the effects of different curricula. Therefore, best practice recommendations for program evaluation (Table 4) are presented within the context of increasing agency and organizational capacity to plan, implement, and use educational program evaluations.

> Program evaluation should be envisioned and undertaken as a systematic and ongoing process that begins when a program is being planned or developed, and that includes both formative and summative components. It should receive both administrative and budgetary support which are included as part of program costs.

Evaluation can be used to align program inputs and processes with short- and longer-term program outcomes and benefits. It can range from pre-assessments of learners to assessments of learning and behavioral outcomes identified in program goals and objectives. Further, an integrated evaluation program makes use of curricular materials that have been carefully reviewed against national criteria and uses these criteria to select and develop new materials, and revise existing materials. A mixture of evaluation methods should be considered with the most appropriate methods selected for each aspect of the program being evaluated. These methods could utilize informal techniques such as question-and-answer sessions, and direct observation of learner competencies and behavior. Formal methods such as quizzes, tests, and surveys are also appropriate in some situations. Finally, alternative/authentic methods that evaluate program outcomes in a more non-traditional manner should be considered. For example, rubrics for performance tasks, projects, and portfolios could be developed to assess learner achievement

One of the limitations of educational programs is the lack of trained staff that can plan and carry out evaluations. Thus, allowing program staff (including administrators, coordinators and instructors) to take advantage of professional development opportunities in the areas of assessment and evaluation builds greater capacity for staff to become directly involved in undertaking these activities and applying the results from sound program evaluations. Agencies lacking this capability can build partnerships with institutions, agencies and consultants with experience in conducting formal evaluations.

Table 5: Best Practices for Research

Effective research:

- Allows program staff to explore and recognize both the value of and the need for research that is relevant to their program.
- Is organized and communicated in ways that provide opportunities for program staff to become aware of and generally familiar with collections, reviews, and summaries and syntheses of research relevant to their program.
- Is organized and communicated in ways that permit program staff to incorporate major research findings into the design, development, implementation, and evaluation of a program.
- Is organized and communicated in ways that help program staff become aware of, explore, and share both apparent gaps in existing research and additional research needs.
- Allows program staff to take advantage of professional development opportunities that enhance their abilities to understand the implications of research for their program and strategies for making use of that research.
- Allows program staff to take advantage of professional development opportunities that enhance their research skills and thereby strengthen their capacity to become meaningfully involved in the research process (e.g., as in action research).

Educational Research

There is an acute need for aquatic education-related research. The authors of the papers in this report uncovered only a handful of articles examining the efficacy of aquatic education programs. Our ability to answer the question, "Are we having an impact with our education programs?" largely is unanswered. Drawing from the broader environmental education literature has provided some guidance in developing the best practices outlined here. However, differences in instructional methods, curricula, materials, settings, and participant/learners make generalizations to aquatic education programs tenuous. Scientific examination of the relationships among these variables with desired outcomes such as changes in environmental knowledge, attitudes, values, action skills, stewardship behavior, and other individual and social outcomes is not well understood. Further, we need to link research on the social and psychological characteristics of recreational anglers and boaters to educational research.

One of the major reasons for the absence of this type of research has been a lack of capacity by sponsoring agencies and organizations to conduct educational research. Salience or value of aquatic or environmental education research notwithstanding, few fish and wildlife agencies or conservation-related organizations have the in-house capability for identifying research needs, designing appropriate studies, and carrying out the project. As a result of this situation, the best practice recommendations for educational research (Table 5) focus on capacity building within the organization.

This does not mean aquatic education researchers need to be hired. It does mean that program staff should have the capability to recognize and communicate both the value of and the need for research that is relevant to their programs. This can only be accomplished through professional development opportunities that enhance staff research skills. This in turn will strengthen their capacity to become meaningfully involved in the research process and by building relationships with professional evaluators. Commensurate with this recognition is the availability of opportunities for program staff to become aware of and familiar with collections, reviews, summaries, syntheses, and applications of research relevant to their programs. Awareness and research experience will allow program staff to incorporate major research findings into the design, development, implementation, and evaluation of their programs. It will also help them to identify gaps in existing research and additional research needs.

Conclusion

It is beyond the scope of this project to recommend specific strategies, curricula, materials, and leadership techniques that result in changes in specific outcomes. As many of the authors in the following papers point out, achieving desired outcomes is influenced by audience characteristics, learning capabilities, previous knowledge and experience, and other variables unique to local educational programs. An educational pro-

gram that is effective in changing environmental attitudes or developing environmental action skills with one type of group in one location may or may not be effective with different groups or in different locations. Our understanding of the generalizability of programs to groups and settings is extremely limited. While the principles and recommendations made above can help guide us in the direction of achieving effective and efficient programs, we still need to know which programs are effective in reaching their goals and objectives and the conditions that led to success. Fishing, boating and aquatic stewardship education programs need to be based on theory, research and practice.

Summary of Expert Papers

The 11 papers written for this project cut across a variety of disciplines and provide differing perspectives on boating, fishing, and aquatic stewardship education. The purpose of these papers was to present research-based information from diverse areas that would yield best practices when considered altogether by participants attending the workshop. The following is a brief overview of each paper.

Bill Siemer leads off with a discussion of aquatic resource stewardship education and the characteristics of aquatic stewardship education programs that lead to successful changes in environmentally responsible behavior. Changes in both individual- and community-level factors are needed to encourage and sustain stewardship commitment over time. Aquatic education programs that include some type of recreational fishing activity are more effective at establishing responsible environmental behaviors than those that do not. He also advocates that evaluations of educational programs need to be routinely included in program planning.

Julie Athman and Martha Monroe point out that environmental literacy depends on personal commitment and motivation to help ensure environmental quality and quality of life. They point out that the goal of environmental education is to instill in learners knowledge about the environment, positive attitudes toward the environment, competency in citizen action, and a sense of empowerment. Considerable research is reviewed that underscores the importance of these principles and identifies the means to achieve them.

Roseanne Fortner discusses how aquatic stewardship education can be infused with classroom science, math and social studies curricula. She reminds us that ethics and stewardship are societal values that are not ascribed to by everyone and thus can become a source of conflict within a community. She notes that adoption of aquatic and environmental education into school classrooms is highly dependent upon informed and trained teachers. Getting aquatic resource education into the schools can be accomplished by meeting teachers needs for specific topics, having excellent curriculum materials, and delivering them with a strong program of teacher education.

Michaela Zint informs us that although we know much about promoting change in environmental knowledge, skills, attitudes, behaviors, and other factors, this knowledge has not necessarily been applied to aquatic stewardship education. Further, while excellent programs and materials exist, most educators are unaware of them or do not have the necessary pre- and in-service training to use them. She suggests that behavioral changes are possible, but that we are unlikely to achieve them unless we build on past program evaluations and experience.

Alan Graefe provides a broad perspective on boater safety education. While the topic is not directly tied to aquatic stewardship, the principles for disseminating information, developing skills, and getting people to act on what they have learned provides insight into how to achieve desired changes in behavior. He also points out that best practices in boater education are based on a consensus of professional judgment or frequency of use. Like aquatic stewardship education, much more research is needed to understand the effectiveness of various educational approaches.

Myron Floyd helps us understand how to overcome marginality, subcultural, assimilation, and interpersonal and institutional discrimination factors to reach out to diverse audiences. By being vigilant and seeking input from diverse audiences at all phases of the program planning and service delivery, most problems can be identified before programs are implemented. He also suggests that input from periodic focus group sessions or establishing formal information channels with advisory groups can be effective ways of increasing diversity in all programs.

Tom Marcinkowski uses a case study of an issue and action instruction program to focus on the development and application of investigation and evaluation skills to environmental problems and issues. He reviews the research base used to develop various components of the issue and action instruction program and to further refine and extend the program. To be effective, teachers in these programs need to assume the role of guide and facilitator rather than content provider. He advocates the use of a program logic model to organize the program and identify important linkages for evaluation.

Marni Goldenberg uses her experience in the outdoor adventure education field to focus on the curriculum, program and leadership issues involved in changing skills, knowledge, attitudes, and behaviors. She identifies the basic needs in outdoor education, the curricula that have been developed to meet these needs, and the research supporting program design and leadership styles. Ongoing program evaluations are deemed essential if organizations providing outdoor adventure education programs are to meet standards for ethics of care for participants and the environment, leadership quality, and matching participant needs with organizational goals and objectives.

Jo-Ellen Ross brings a much need perspective to including people with disabilities in boating, fishing, and aquatic stewardship education programs. Research on people with disabilities shows they have the same motivations for participating in outdoor activities as other segments of the population. Her discussion of legislation and regulations is informative and helps us understand the legal requirements for access to programs, facilities, and services by people with disabilities to ensure an inclusive environment. She points out that using appropriate terminology also conveys a sense of inclusion for programs and facilities. By using assistive devices and some additional planning, education programs can become inclusive and provide benefits to all segments of the population.

Kathleen Vos summarizes the 4-H Youth Development Program to identify effective strategies for curriculum and leadership development, and program implementation. She advocates moving from a youth development model to a community – youth framework to harness the energy, creativity, and dedication of both youth and adults to create community change. She believes that by integrating research and practice on youth – adult partnerships, experiential learning strategies and the community – youth development movement will help develop a sustainable learning community that brings about change in how communities deal with issues related to boating, fishing and environmental stewardship.

Finally, **Janice McDonnell** builds on her educational experiences with the Jacques Cousteau National Estuarine Research Reserve to highlight innovative educational programs that can be used as a springboard to encourage educators and their students to use the marine environment as a focal point while developing basic skills in reading, writing, math, problem-solving, and critical thinking. The use of model science programs, the development of collaborative school projects, and Internet connections can make science education exciting and relevant to current environmental policy issues. She advocates educators short-circuiting the arduous rote memorization exercises commonly associated with the study of science, and replace it with first-hand experiences found within the scientific and cultural resources of the state or region.

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Best Practices For Curriculum, Teaching, and Evaluation Components of Aquatic Stewardship Education

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Abstract – Stewardship education is a process designed to develop an internalized stewardship ethic and the skills necessary to make considered choices and take environmentally responsible actions. To be most successful, stewardship education programs should be designed to influence beliefs, values, intentions, action skills, and behaviors related to specific environmental issues. Programs should address the entry-level, ownership level, and empowerment level variables that have been correlated with behavior change. These variables include: environmental sensitivity; knowledge about ecology; in-depth understanding of aquatic environmental issues; a sense of personal investment in specific environmental issues; knowledge of environmental action strategies; skills in using environmental action strategies; an internal locus of control; and intentions to take action. Stewardship education should be viewed as a set of sequential learning experiences that take place over an extensive time period, in a combination of formal and nonformal settings, within the context of a supportive social environment. Comprehensive and extensive teacher training should accompany formal and nonformal programs. Programs should incorporate family, peer group, and community group involvement. The role of the instructor or teacher should be one of facilitator, or guide to the learner. Early outcome evaluation should focus on attitude research as a key to understanding whether progress is being made toward laying the groundwork for behavior change in program participants. Changes in the cognitive, affective, and conative components of attitudes should all be explored (i.e., examine outcomes such as change in knowledge, understanding, opinions, motivations, and behavioral intent). Stewardship education professionals should take a comprehensive approach to evaluation. That is, detailed formative evaluation should precede any summative assessments. Outcome evaluation should not proceed until it is clearly demonstrated that program design, implementation, and longevity are sufficient to expect particular behavioral changes. The author recommends that leaders in this field: (1) develop better indicators of program influences on attitudes, motivations, and behaviors; (2) establish a few long-term and longitudinal research projects associated with fully developed programs; and (3) conduct additional research on incentives and disincentives to engage in stewardship behaviors.

What Makes For Effective Stewardship Education?

A sound theoretical or conceptual framework is the best foundation for constructing and evaluating aquatic stewardship education programs. Literature-based definitions of stewardship and ethics-based stewardship education are needed to provide a conceptual structure from which the parameters of stewardship may be identified. Further, key assumptions underlying stewardship education programs need to be recognized so educational approaches that have shown promise as a means to achieve desired outcomes related to stewardship can be evaluated.

A Working Definition of Environmental Stewardship

Based on an extensive review of literature, Dixon et al. (1995:42-43) provided the following working definition of environmental stewardship. We believe this well-grounded and comprehensive definition provides a useful foundation for stewardship education programs.

Stewardship is the moral obligation to care for the environment and the actions undertaken to provide that care. Stewardship implies the existence of an ethic of personal responsibility, an ethic of behavior based on reverence for the Earth and a sense of obligation to future generations. To effectively care for the environment, individuals must use resources wisely and efficiently, in part by placing self-imposed limits on personal consumption and altering personal expectations, habits and values. Appropriate use of natural resources within the stewardship ethic involves taking actions that respect the integrity of natural systems.

It is important to recognize that the stewardship concept defined by Dixon et al. (1995) encompasses many basic values and may actually represent different

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ethical orientations across individuals. For example, some individuals and organizations may have an understanding of stewardship that is grounded in beliefs about the intrinsic values of fish and wildlife (Negra and Manning 1997). Other individuals and organizations ground their understanding of stewardship in beliefs related to utilitarian values of fish and wildlife (Negra and Manning 1997). Individuals involved in aquatic education programs may incorporate either perspective or a mix of both in their programs.

The reader also should note that, while many would agree that stewardship involves reverence toward the environment, they may disagree on the source of this reverence. For some, the source may be religious. For others, the source may be secular or spiritual (Negra and Manning 1997). Individuals involved in aquatic education programs may take very different approaches to developing a sense of reverence toward the natural environment.

A Working Definition of Ethics-based Stewardship Education

The Dixon et al. (1995) definition of stewardship includes terms such as ethics, morality, responsibility, and obligation. These terms reveal that aquatic environmental stewardship is a concept embedded within some system of ethics. Thus, in order to proceed with an analysis of best practices, one needs to establish working definitions of ethics and ethics-based stewardship education.

Frank Goble and David Brooks, who have been involved in character education programs developed by the Thomas Jefferson Center for Research, offer a useful working definition of the term ethics. They echo a definition provided by Albert Schweitzer and adopted by many others in the character education field: "In a general sense, ethics is the name we give to our concern for good behavior. We feel an obligation to consider not only our own personal well being, but also that of others and of human society as a whole" (Goble and Brooks 1983:iv; cited in "Common Sense and Everyday Ethics", Ethics Resource Center, Washington D.C., 1980). Educators and education program developers have used the terms ethics, morals, and character interchangeably to refer to the same concept: an internal system that determines correct behavior (Greer and Ryan 1989:26).

Proponents of character education believe that ethics, morals, and values provide guidelines for behavior. They believe that ethics, morals, and values show people the "path to become a good person" (Ryan 1993:16). What has variously been referred to as ethics education, moral education, or character education, is the process of teaching values and helping people develop the skills and experiences they need to solidify those values as internal guidelines for behavior.

It is important to recognize that many education scholars recognize teaching ethics, values, and morality as important and legitimate goals within formal education settings Education scholars have suggested that the goal of curriculum -- the set of ideas conveyed through formal education experiences -- is not just to teach something in a specific field or content domain (though that goal is embedded in most curriculum and may be primary in formal education settings). The goal of a curriculum also may be to: 1) produce well-adjusted adults; 2) produce "good" citizens; 3) or produce an ethical populace (Tyler 1949). In formal education, moral education has been defined as "what schools do, consciously and unconsciously to affect the way students think, feel, and behave concerning issues of right and wrong" (Greer and Ryan 1989:26). Ethical/moral education is not a new educational fad. "Character education is as old as education itself. Down through history, education has had two great goals: to help people become smart and to help them become good" (Lickona 1993:6).

Ethics-based environmental stewardship education may be considered a specific application of character education. It seeks to lay out a path of decisions and actions by which one may live an environmentally responsible life. Aquatic education programs may be designed to take on this educational challenge in a specific context -- enabling people to extend ethical considerations to their choices and actions as an angler or boater.

Wendell Berry (1987:7) wrote that nature "...is not only our source, but also our limit and measure." Understanding our choices, and how nature is both our limit and measure, enables humankind to choose appropriately in order to sustain both their humanity and nature, for the present and the future. Empowering learners to think critically– to understand the impacts and consequences of the choices they make, to choose the most right course–and to take appropriate action in implementing right choices ought to be the aim of aquatic stewardship education in a democratic society.

An ethics-based valuing of the environment, then, drives stewardship. In addition to developing critical thinking and decision-making skills, and empowering learners to take stewardship actions, aquatic stewardship education ought to include a consideration of the role ethics plays in supporting and underlying environmental stewardship.

We can conceptualize ethics-based stewardship education as a process of developing what have been described as ethical competence and ethical fitness. Quinnett (1994:117), suggests ethical competence involves certain skills, including the:

- Sensitivity to recognize a situation as posing one or more ethical considerations;
- Knowledge of what responses are legal versus what responses might be ethical in that situation;
- Willingness to act;
- Judgment to weigh various considerations where there are no laws or guidelines;
- Humility to seek consultation and additional knowledge to guide one's action.

According to Kidder (1995:57), ethical fitness is "a capacity to recognize the nature of moral challenges and respond with a well-tuned conscience, a lively perception of the difference between right and wrong, and an ability to choose the right and live by it."

In summary, we can define ethics-based stewardship education as a process designed to develop an internalized stewardship ethic and the skills (i.e., critical thinking; decision-making; ethical competence; ethical fitness; and action skills) necessary to make considered choices and take environmentally responsible actions. Ethics-based stewardship education should provide internal guidelines for responsible behavior toward the natural world in a variety of situations that one might encounter in everyday life. Ethics-based aquatic education is intended to develop internal motivations and guidelines for responsible behavior toward other people and their activities while one is engaged in some aspect of fishing or boating (Matthews and Riley 1995). As an ultimate goal, aquatic stewardship programs should strive to develop internal guidelines that will later serve as a foundation for responsible behavior toward the natural world in a variety of situations that one experiences beyond the specific contexts of fishing or boating.

Education Approaches Likely to Achieve Desired Outcomes

The literature identifies a number of characteristics of stewardship education programs that appear to be most promising as vehicles to stimulate environmentally responsible behavior. Exploring what researchers have found with regard to curriculum content, teaching methods (delivery), and activities suggests a number of criteria for guiding aquatic stewardship education practices.

The field of environmental education has long recognized the importance of the interplay of awareness, values, attitudes, knowledge and responsible environmental behavior but, as we have noted, has been hampered by reliance on inaccurate models. Until the 1980s there was no comprehensive, useful summary of the large body of environmental education research. Then, a rigorous meta-analysis of this research, conducted by Hines et al. (1987) provided some breakthroughs in environmental education theory and practice, and a more grounded basis for environmental education policy initiatives. These researchers came to 3 important conclusions:

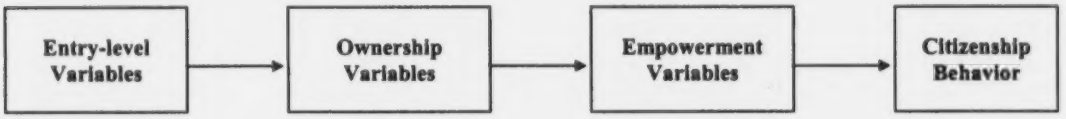
1. Developing awareness and ecological knowledge is not enough to cause long-lasting behavior changes.
2. Ownership – developing a personal connection with and knowledge of issues is critical to responsible environmental behavior.
3. Instruction that focuses on ownership and empowerment (a sense of being able to make changes and resolve important problems, and use critical issues investigation skills to do so) changes behavior (Hungerford and Volk 1990).

Hungerford and Volk (1990) extended the work of Hines et al. (1987) by identifying three categories of variables that contribute to environmentally responsible behavior and suggesting that these variables operate in a linear or progressive fashion (Figure 1). Following the work of Hines et al. (1987), Hungerford and Volk (1990), and Knapp et al. (1997), these variables are labeled: 1) entry-level variables; 2) ownership variables; and 3) empowerment variables. Entry-level variables, according to Hungerford and Volk (1990), are good predictors of behavior or ones that appear to be related to responsible citizenship. They include environmental sensitivity and knowledge about ecology.

Ownership variables personalize environmental issues, creating individual ownership of the problem or issue. Ownership variables appear to be critical to responsible environmental behavior (Hungerford and Volk 1990). They include an in-depth understanding of the issues and personal investment in and identification with the issue.

Empowerment variables give human beings a sense that they can make changes and help resolve important environmental issues (Hungerford and Volk 1990). Empowerment variables include perceived skill in using environmental action strategies and skills, knowledge of action strategies, an internal locus of control, and the intention to act. Hungerford and Volk assert that a progression exists from entry level through empowerment,

Figure 1. Major and Minor Variables in Environmentally Responsible Behavior.



Major Variables	Major Variables	Major Variables
Environmental sensitivity	In-depth knowledge about issues	Knowledge of and skill in using environmental action strategies
	Personal investment in issues about the environment	Locus of control (expectancy of reinforcement)
Minor Variables	**Minor Variables**	**Minor Variables**
Knowledge of ecology	Knowledge of the positive and negative consequences of behavior	In-depth knowledge about issues.
Androgyny	Personal commitment to issue resolution	

Source: Hungerford and Volk 1990.

and that pro-environmental behavior will be more likely if all three levels of variables are included in an education program. They also recognize that this process takes place over time, may call for sequentially, complementary education efforts, and may work best when learning occurs in a combination of formal and nonformal learning environments (Hungerford and Volk 1990).

The variable that Hines et al. (1987) labeled "environmental sensitivity" is of special interest to developers of programs that incorporate outdoor experiences. Environmental sensitivity refers to an increased level of empathy toward the natural environment. Studies suggest that environmental sensitivity is developed through significant, positive contact with the outdoors over a long period of time (Chawla 1998, 2000). For example, research into significant life experiences (Tanner 1980; Peterson 1982) supports the notion that adults exhibiting conservation leadership and involvement in environmental careers share a common set of experiences involving the outdoors and outdoor activity, such as fishing, when youngsters. Frequently, these experiences included adult family members and significant others from the youngsters' social world that were available to guide and mentor them.

Kellert (1987) offered a possible explanation for the association between outdoor experiences and environmental sensitivity. He suggested that "a personally meaningful environmental ethic requires a fundamental sense of affection for and identification with nature, and a related capacity to perceive oneself as an integral and obligate member of the ecological community; and ... unethical behavior is often associated with feelings of alienation ...from nature, allowing oneself to abuse and exploit the biota for various egoistic needs and immediate gratifications divorced from feelings of personal

guilt or long-term responsibility" (Kellert 1987:19). Fishing is one outdoor activity that may develop the deeply personal connection with nature that Kellert (1987) suggested is needed to counter alienation and apartness leading to unethical behaviors. Further, Hungerford and Volk (1990) suggested that if these research studies are to help us make educational decisions about developing environmental sensitivity, it seems important that learners have environmentally positive experiences in nonformal outdoor settings over long periods of time.

Hungerford and Volk (1990) identified a research support base for 6 critical educational components that, when implemented, can maximize behavioral change (Table 1). Their focus on including action components in the curriculum in order to affect behavior is supported by several studies conducted at Southern Illinois University (Culen and Volk 2000, Klinger 1980, Ramsey 1987, and Simpson 1989). According to Weigel (1985:75) effective behavioral change occurs when "in addition to providing knowledge about an issue, information (is also) made available regarding both the type of action implied by that knowledge and specific guidance as to how to carry out that type of action." The specificity of the behavioral message is critical to effecting behavioral change (Weigel 1985). Howe and Disinger (1988) found that the demonstration of responsible environmental behavior is linked to long-term student involvement with environmental issues. To reach this point, Howe and Disinger (1988) suggested that learners need to have knowledge of ecological concepts, knowledge of the environmental issues involved, concern for the quality of the environment, knowledge of effective action strategies, a belief in their ability to make a difference, the commitment to act, and actual experience in action-oriented activity.

Hungerford and Volk's (1990) work offered an important advance in program design. Many of the environmental education programs developed in the 1960's and 1970's were based on a "hypodermic needle" model of communication (Winett 1992). In this model, the audience simply receives "inoculations" of information, and then is supposed to act in relatively predictable and desirable ways. Communication research has shown this approach to be overly simplistic and largely ineffective (Stern 1992), though some studies suggest that youngsters exposed to formal environmental education are more inclined than a control group to demonstrate

Table 1. Critical Components of Environmental Behavior Change Programs.

"It appears that we can maximize opportunities to change learner behavior in the environmental dimension if educational agencies will:"

1. Teach environmentally significant ecological concepts and the environmental interrelationships that exist within these concepts;
2. Provide carefully designed and in-depth opportunities for learners to achieve some level of environmental sensitivity that will promote a desire to behave in appropriate ways;
3. Provide a curriculum that will result in an in-depth knowledge of issues;
4. Provide a curriculum that will teach learners the skills of issue analysis and investigation as well as provide the time needed for the application of these skills;
5. Provide a curriculum that will teach learners the citizenship skills needed for issue remediation as well as the time needed for the application of these skills; and
6. Provide an instructional setting that increases learner's expectancy of reinforcement for acting in a responsible way; i.e., attempt to develop an internal locus of control in learners.

Source: Hungerford and Volk 1990.

pro-conservation behavior (Asch and Shore 1975; Leeming et al. 1993). The simple hypodermic needle model of communication fails when there are competing sources of information, when information is not well-crafted, when information is difficult to act upon, in unusual or less controlled situations (as in informal communications), or when issues are complex (Winett 1992). These descriptors frequently apply to aquatic resources education settings, casting doubt on the efficacy of this simple communication model for fishing and boating education programs with a stewardship action agenda.

Social Context

Educational programs designed to change behaviors also should consider the social context surrounding the environmental issues of interest (Laska 1990). Program designers should view the desired behavior changes within the context of the worldview shared by those involved with or affected by the issue. Developing programs that consider the salient social may enhance the likelihood of producing target behaviors and cultural norms in the community served by the program.

The literature on character, morals, ethics, and values education clearly establishes the importance of understanding the influence of social context on the success of the educational effort (Leming 1993a, 1993b; Matthews and Riley 1995). In stewardship education, the social context in which the education takes place is at least as important as the methodology by which stewardship concepts are taught. If not grounded within the particular community and cultural context of the learner, stewardship education will remain abstract, outside the scope of experience of the learner, inconsistent with cultural norms, and ultimately irrelevant (Berger and Neuhaus 1977; Hauerwas 1981; Sichel 1988).

Belonging to and identifying with a group is important for an individual's personal development. Researchers have identified group and community as important variables in the development of ethics and values (Hauerwas 1981). Community can include family, school, ethnic community and groups to which one belongs, such as 4-H or Girl Scouts (Sichel 1988; Berger and Neuhaus 1977). Family, peers, and others in the community transmit their attitudes, beliefs, and values to participants in aquatic stewardship programs. Group members positively influence or actually initiate an individual into activities like fishing and boating, and can encourage or discourage stewardship behaviors associated with those activities (Dann 1993, 1998).

This suggests that to be most effective, stewardship education programs should use small groups, emphasize peer activities, focus on relevant issues, and involve action learning. Mentoring, community clubs, and family programs implemented over the long term may build the kinds of moral communities that we know will facilitate ethics education (Matthews and Riley 1995). Aquatic stewardship programs will be most effective in reaching behavioral goals if designed to incorporate parents, family, and neighborhood as part of the learning community.

Stewardship Incentives and Barriers

Dwyer et al. (1993) reviewed the research completed during the 1980's dealing with behavioral change related to the environment as a result of interventions designed to effect that change. They found that "antecedent conditions using commitment, demonstration, and goal-setting strategies were generally most effective in encouraging environmentally responsible behavior, and consequence conditions were effective in producing behavior change during the experiment's duration" (Dwyer et al. 1993). They also noted that little comparison of interventions had occurred, the little follow-up research that did occur found that the behavioral changes were generally not maintained, and many potentially effective intervention strategies have been ignored (i.e. group interventions and penalties) (Dwyer et al. 1993).

Many of the intervention strategies and behavior-change techniques described by Dwyer et al. (1993) may be of interest to stewardship educators. They grouped these strategies into two major categories, antecedent conditions and consequence conditions. The antecedent conditions include passive, active, individual, and group techniques intended to encourage target behaviors. The studies reviewed by Dwyer et al. show that prior commitment to conserve consistently resulted in behavior changes persisting over follow-up measures of up to 12 weeks (Dwyer et al. 1993). Some strategies that may be effective include:

- Getting the learner to commit to doing some target behavior.
- Getting the learner to select a personal or team goal related to a target behavior.
- Engaging the learner in-group competition related to a target behavior.

Some programs also use oral or written "activators" to prompt conservation behaviors. Dwyer et al. (1993:291) found "little convincing evidence that even intensive mass media campaigns promoting conservation have had appreciable effects." This finding is consistent with the notion that information alone is not enough to change behavior.

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Some researchers have found that feedback, rewards, and penalties can produce short-term behavior change. However, when these consequence conditions are removed, people immediately return to their original behavior patterns (i.e., they stop participating in the target activity). As Dwyer et al. (1993:304) stated, "The challenge remains to encourage behavior maintenance." These studies suggest that feedback, rewards, and penalties may have some promise for stewardship education programs, but by themselves, they are not likely to produce lasting behavior change or development of environmental citizenship.

In the research examined by Dwyer et al. (1993), no studies were found examining individual or group goals where the subjects were involved in setting the goal. This is unfortunate in light of the promise this type of method appears to hold in the outdoor ethics education arena (Leming 1978, 1993a, 1993b; Matthews and Riley 1995).

A summary of literature by Gray et al. (1985) generally found that external strategies, such as financial incentives, were effective in changing behavior, though some evidence suggests the change was short-term. Persuasive communications that provided information alone were not enough to effect change. Of real interest to stewardship educators is evidence supporting norm-activation as a strategy for influencing behavioral change (Schwartz 1977, cited in Gray et al. 1985). The importance of the group context in influencing norms has also been stressed (Stern 1978, cited in Gray et al. 1985).

Stewardship incentives or barriers/constraints may encourage or discourage environmental stewardship actions. Behavioral incentives or barriers may be cultural, psychological, economic, political, or sociodemographic in nature (Dixon et. al. 1995).

Constraints might be: intrapersonal (not feeling able to perform the behavior, lacking skills or confidence), interpersonal (not having someone to do the behavior with, having someone who is discouraging them from taking part), or structural (lack of time or money, lack of access to a site to perform the behavior). Additional barriers may be cultural, political, or sociodemographic (Dixon et. al. 1995). Environmental educators must seek to understand and identify these constraints and design aquatic education programs to minimize or even eliminate such barriers.

Teachers, Teacher Training, and Teaching Methods

A number of researchers have provided evidence that teaching styles and methods are important to the success of environmental education programs. Hungerford and Volk (1990) stressed that teachers who are positive role models can increase the likelihood of desired stewardship outcomes. Ramsey and Rickson (1976) provided evidence that teaching methods/strategies, behaviors, and leadership styles are important variables in the learning process. May (2000) provides evidence that teachers themselves believe these elements to be critical to successful environmental education.

Perhaps the most difficult challenge facing the stewardship educator is creating the basis for long-term behavior change based on an internalized stewardship ethic. As has been mentioned earlier, this is essentially an exercise in character education. The role of the teacher, and the type of interaction he or she has with students, is critical to the effective character education process (Leming 1993a, 1993b).

Much more research is needed before a comprehensive theory of effective character education will emerge (Leming 1993b), but researchers evaluating the outcomes of drug, alcohol, and violence prevention programs have documented the effectiveness of some approaches to character education. The following practices and strategies have proved to be ineffective in producing target behavior changes in youth program participants: lecturing and moralizing; use of charismatic hero figures to lead and inspire; use of authoritarian teachers/leaders; codes of ethics derived by adults or others outside the peer group; and values clarification (Leming 1978, 1993a, 1993b). However, some approaches have proved more effective in changing learner behavior. These include: small group settings where learners participate in setting their own as well as the group's learning agenda; peer guidance and peer counseling approaches; peer group activities involving problem solving and developing group norms and codes of behavior; focusing on behavioral issues of relevance within the cultural context of the learners and their communities; creating positive and mutually respectful learning climates; and establishing adults as participant-learners and guides in the ethics education process (Leming 1978, 1993a, 1993b).

Damon (1993:1) suggested, "The enterprise of teaching children values in school is often an indirect one. Where core values are concerned, teachers often communicate more by their manners than through explicit messages." Clifford Knapp, in his book *Lasting Lessons*, emphasized the importance of teachers as guides who help learners reflect on their experience, to make the learning experience more meaningful. By reflecting on the experience of, say, an angling ethics education exercise, the meaning of the experience be-

comes that much more personal and relevant, and ultimately more powerful and long lasting. Knapp noted that educators are just beginning to understand the value of constructing the meanings and interpreting the connections inherent in experience and that real learning requires meaning-making (Knapp 1992).

Fortner (1991) suggested that teacher training is a must to assure the highest level use of curriculum materials. Evaluation of programs, such as Project Wild, document that curriculum materials go unused unless supported with in-depth in-service training for teachers (Paul and Burde 1997). Without training in use of curriculum materials or recommended teaching strategies, teachers may not be able to achieve many of the goals or objectives of a stewardship education program.

The environmental education community is in substantial agreement that lack of teacher training is a common cause of program failure (UNESCO 1997), but this recognized deficiency remains a persistent problem within the U.S. and throughout the world. Knapp (2000) urges the environmental education community to adopt extensive teacher training as the cornerstone of environmental education. Those interested in aquatic stewardship education would do well to adopt Knapp's recommendation.

Temporal and Contextual Factors

The education literature also suggests that stewardship education programs sustained over time are the most likely to create long-lasting program outcomes. Studies suggest that if stewardship behavior is to be maintained there must be follow-up support to help maintain it. Behavioral change research points very clearly to the fact that, even when strong short-term behavioral change occurs, the prognosis for long-term change is highly doubtful without continued application and reinforcement of the intervention strategy (Dwyer et al. 1993, Hungerford and Volk 1990). According to Hungerford and Volk (1990:14), "In light of Ramsey's follow-up study, it seems obvious that learners need to be reinforced for positive environmental behavior over time. ...it is evidently imperative that learners get in-depth educational experiences over a substantial amount of time." Some educators recommend that stewardship education programs contain a set of stewardship apprenticeship experiences that the learner shares over a sustained period of time with a personally significant person.

Contrary to Hungerford and Volk's (1990) recommendation, most contemporary environmental education seems to take the form of short-term program modules or individual lessons. In an international conference celebrating the 20th anniversary of the Tbilisi Doctrine on environmental education (TICEE 1978), more than 1,000 educators reaffirmed the notion that such piecemeal approaches need to be replaced with in-depth and sustained programs.

> *"...those short-and sweet strategies have negated the use of more substantial models that encourage long-term issue investment and, most important, long-term thinking and responsible citizenship behavior on the part of students."* (Knapp 2000:34).

To be effective, aquatic stewardship education has to cut across formal and nonformal learning contexts, as well as occurring across a span of time. Knapp (2000) urges schools and non-government organizations to partner to achieve effective environmental education.

> *"The ultimate aim of environmental education cannot be accomplished alone. In particular, we must begin to find new and better ways to combine formal environmental education efforts with those of nonformal environmental education. The similarities between them require that the success of either depend on partnerships."* (Knapp 2000:36)

Environmental stewardship means accepting personal responsibility for how one's actions affect aquatic environments and taking actions (i.e., expressing behaviors) that reflect the existence of an ethic of personal responsibility. Ethics-based stewardship education is a process designed to develop an internalized stewardship ethic and the skills necessary to make considered choices and take environmentally responsible actions. Ethics-based stewardship education is a specific type of character education, and as such, involves teaching people how to behave toward aquatic environments. The ultimate aim of aquatic stewardship education, and environmental education generally, is to develop environmentally responsible citizens.

Developing environmentally responsible citizens requires more than raising awareness, knowledge, and concern about the environment. To be most successful, stewardship education programs should be designed to influence beliefs, values, intentions, action skills, and behaviors related to specific environmental issues. In other words, programs should address the entry-level, ownership level, and empowerment level variables that have been correlated with behavior change. These variables include: environmental sensitivity; knowledge about ecology; in-depth understanding of aquatic environmental issues; a sense of personal investment in specific environmental issues; knowledge of environmental

action strategies; skills in using environmental action strategies; an internal locus of control; and intentions to take action.

The challenges of this kind of change process are too great to be addressed by any single person or program. Program developers should view this as a process that occurs over an extensive period of time, through sequential learning experiences that take place in a combination of formal and nonformal settings, within the context of a supportive social environment. Continued applications and reinforcement are necessary to produce long-term behavior change. Continued, sequential programming also can increase the probability of desired behaviors if those programs increase the incentives and reduce the barriers to short-term behavior change. Program developers should keep in mind that school-based stewardship programs are unlikely to be adopted or utilized effectively unless supported with comprehensive and extensive teacher training. Training should be an integral part of nonformal stewardship programs, as well.

The social context of stewardship education is especially important, because family and community play such a significant role in the development of values and ethics. To be most effective, stewardship education programs should incorporate family, peer group, and community group involvement with an eye toward developing a supportive moral community where a stewardship ethic can be nurtured and developed over time. The role of the instructor or teacher should be one of facilitator, or guide to the learner.

Recommendations for Stewardship Education

The need for evaluation of new and existing environmental education programs is widely recognized (O'Hearn 1982, Lucko et al. 1982). For example, in a paper titled *Setting the Agenda for Outdoor Ethics Education*, Bruce Matthews and Cheryl Riley made the following statement.

> *...the methods or strategies developed and used for outdoor ethics education all too frequently are based not on research evidence supporting their effectiveness, or even on critically accepted education theory, but on what another program or agency is doing. Only in a very few instances have attempts been made to evaluate outdoor ethics education efforts, and these have not supported the effectiveness of the ethics education approach used (Bromley et al. 1989, Jackson and Norton 1979). In this day of accountability, we must be able to show evidence that our outdoor ethics education efforts are effective and based on sound educational theory. When we do less, we do a disservice not only to those we are attempting to educate but to the resource, the outdoor activity and to ourselves.* (Matthews and Riley 1994:592)

A myriad of activities and curricula have been developed for formal and informal teaching applications, but few of these programs have been formally evaluated with regard to goal achievement, knowledge gains, or changes in attitudes or behavior. For example, a national survey of environmental educators about 20 years ago (Disinger 1981) found about 7% of K-12 environmental education programs had been subjected to a formal program evaluation, 43% had been evaluated informally, and 50% had not been evaluated at all. Some notable exceptions to this trend exist, of course. Project WILD, for example, has enjoyed a comparatively large amount of attention from evaluators. Yet, it is reasonable to say that program evaluation remains uncommon two decades after Disinger's survey of educators.

Implicit in a discussion of guidelines for evaluation of aquatic stewardship education programs is an acknowledgment of gaps in evaluation methods and applications. Some of the key gaps in understanding are summarized in Table 2. Table 2 could be much longer, given that so little evaluation of stewardship programs has gone beyond simple description of program activities and numbers of program participants. All of the practices recommended earlier are supported to some degree in the environmental education literature, but the application of those ideas in aquatic stewardship programs has not been examined extensively within the context of carefully designed studies.

Take a Comprehensive Approach to Evaluation

Too often, the task of program evaluation is reduced to a summative judgment of whether desired outcomes were achieved. This kind of summative evaluation is useful but incomplete. As an overall recommendation, stewardship education professionals should take a comprehensive approach to evaluation (Decker 1990). By comprehensive, evaluation that includes detailed formative evaluation in advance of any summative assessments is needed.

A comprehensive approach allows one to answer four questions:

Table 2. Summary of Gaps in Information about the Effectiveness of Recommended Practices for Aquatic Stewardship Education Programs.

Topic Area	Research Questions in Need of Greater Attention
Knowledge	To what degree do increases in knowledge contribute to changes in learner behavior?
Attitudes and behavior	To what degree do positive attitudes toward the environment and aquatic resources contribute to expression of environmentally responsible behavior?
Attitudes and behavior	Under what conditions does expression of stewardship behavior serve as feedback to influence stewardship attitudes?
Attitudes and behavior	Are there specific attitudes that are associated with expression of environmentally responsible behavior?
Attitudes and behavior	What attitudes are activated in particular aquatic stewardship situations, and what attitudes are used by the actor to make decisions and take actions?
Norms	Does norm activation within stewardship programs influence learner behavior?
Motivations	What motivates boaters and anglers to engage in specific types of environmentally responsible behavior?
Antecedent conditions	What types of incentives and rewards encourage specific desired environmentally responsible behaviors?
Consequence conditions	What types of disincentives and penalties encourage specific desired environmentally responsible behaviors?
Intentions	How does perceived locus of control and perceived responsibility influence intention to take environmentally responsible actions?
Social support	Are stewardship programs that include family and peer groups more likely to produce desired stewardship behaviors than programs without family and peer group involvement?
Apprenticeship experiences	Are stewardship programs that include apprenticeship experiences with mentors more likely to produce desired stewardship behaviors than programs without an apprenticeship component?
Apprenticeship experiences	How many apprenticeship experiences, over what period of time, are needed to produce long-term expression of environmentally responsible behavior by angers and boaters?

1. Was the underlying program model faulty?
2. Was the implementation of the program model appropriate and carried out as prescribed?
3. Were expectations of outcomes/impacts unrealistic, therefore unattainable?
4. Was the evaluation itself adequate in terms of methods, impact indicators examined, people contacted, etc. to obtain valid, reliable, and programmatically meaningful information? (Decker 1988:19).

Questions one through three above can be addressed through a process called an "evaluability assessment" (Smith 1989). Examples of evaluability assessments related to stewardship education programs are provided by Siemer and Brown (1997, 1998), and Siemer et al. (1998). An evaluability assessment is a thorough examination of a program and its elements. Done well, it will reveal much about the plausibility a program has as a vehicle to produce desired stewardship outcomes. It identifies needs that must be addressed before more extensive evaluation can be conducted efficiently and effectively. For example, an evaluability assessment will clarify the degree to which local programs have been implemented as planned (this is sometimes referred to as "implementation fidelity). Evidence of poor implementation fidelity raises questions about the plausibility of reaching program goals. A finding of poor implementation fidelity should tell evaluators that additional evaluation steps would be inefficient until program implementation is improved.

Develop a Better Understanding of Attitude – Behavior Linkages

For the past 25 years, researchers and practitioners in environmental education, environmental behavior, social marketing, and human dimensions of fisheries and wildlife management have been examining factors which contribute to the development of responsible environmental behavior (Stern 1992). This notion of stewardship is built on the assumption that "the ultimate aim of education is shaping human behavior" (Hungerford and Volk 1990:8). Yet, these researchers recognize that the factors contributing to stewardship behaviors represent a complex web of interlinked precursors. Researchers have found evidence associating environmental behavior with antecedents that include: attitudes, locus of control, knowledge, sense of responsibility, social norm, environmental sensitivity, and behavioral intentions (Hwang et al. 2000).

Because of the complexities associated with educating and evaluating in this domain, researchers have been examining quantitative measures (i.e., indicators) of behavioral and other changes to provide clues as to the effectiveness of stewardship and environmental education (Dixon 1996; Dixon et al. 1995; Matthews & Riley 1995; Siemer et al. 1995). The following subsections examine the relationship between behavior and other factors such as attitudes, motivations and intentions, and reviews several broad categories of indicators that others have used to assess outcomes from environmental education programs. Advances in the field of stewardship program evaluation are dependent upon improved measurement of indicators in all of the categories discussed below.

Attitudes and Behavior

For the purpose of examining the concept of aquatic stewardship, it is useful to conceptualize an attitude as an underlying disposition entering into the determination of a variety of behaviors toward an object or class of objects (Weigel 1985). Social psychologists have suggested that attitudes consist of three components: cognitive (beliefs, facts, principles, knowledge, or understanding); affective (emotion, feeling, or emotional evaluation); and conative (behavioral tendency or intent) (Weigel 1985).

Embedded in the field of environmental education is an operating assumption that greater environmental understanding will contribute to positive changes in learner behavior. Although this assumption has driven environmental education for decades, an empirical basis for this relationship is still developing and merits a great deal more research attention.

While some psychologists (e.g., Festinger 1957, Fishbein and Ajzen 1975, Azjen and Fishbein 1980) have collected data to support the theory that "actions flow from attitudes" (Weigel 1985:72), others (e.g., Bem 1972) have collected data to support the theory that overt behavior promotes the development of internalized attitudes. Weigel (1985) states that contemporary research suggests a reciprocal relationship between attitudes and behavior. This means that programs intended to influence environmental attitudes or behavior have the potential to influence both, and both should be considered in the process of developing educational interventions. This reciprocal relationship should be explored within the specific context of aquatic stewardship education programs.

Changing Behavior

Actual behavior change is the ultimate aim of environmental education generally (Hungerford and Volk 1990) and aquatic stewardship education specifically. Creating behavior change, however, especially the long-term changes sought as evidence of successful stewardship education, is a tall order. Early research in outdoor and environmental education often made the assumption that changing an individual's knowledge of and concern about an environmental issue would produce attitude change, which in turn would result in more environmentally responsible behaviors by environmental program participants. Environmental education research generally has provided weak evidence of the assumed links between environmental understanding, attitudes, and environmentally-responsible behavior (Brown and Manfredo 1987; Borden and Schettino 1979; Dwyer et al. 1993; Fortner and Mayer 1983; Gigliotti 1992a; Hines et al. 1987; Hungerford and Volk 1990; Kellert 1992; Marcinkowski 1989; Ramsey and Rickson 1976; Rokeach 1972; Sia et al. 1986; Sinden and Worrell 1979; Sivek 1989; Zelezny 2000). In this regard, the experience of environmental education researchers has been no different than that of social psychology researchers more generally. Since the 1930's, multiple researchers (e.g., LaPiere 1934; Kiesler et al. 1969; Wicker 1969) have completed studies that show only a weak association between opinions and actions. These findings prompted serious concerns about the usefulness of attitude research and the influence of attitudes and attitude change on behavior (Weigel 1985). However, more recently, researchers have provided evidence that certain attitudes can serve to support and possibly even predict certain environmental behaviors (Hines et al. 1987; Borden & Schettino 1979; Marcinkowski 1989; Sia et al. 1986; Sivek 1989; Stern 1992).

Attitudes can be used to predict behavior more con-

sistently if the researcher takes measures to account for the social, psychological, and situational variables known to influence expression of behavior (Ajzen and Fishbein 1980, Fishbein and Manfredo 1992). At least six factors have been identified that influence behavioral expression of attitudes: specificity, intentionality, ambiguity, level, vested interest, and self-monitoring (Crano and Messe 1982). It is reasonable to assume that these influences will operate on participants in boating and fishing education programs, but those assumptions need to be examined through controlled studies of actual programs.

Specificity refers to "matching the degree of specificity of the measured opinion with that of the potential behavioral expression of the opinion" (Crano and Messe 1982:194). For example, Weigel (1985) cited evidence that highly focused attitude measures will yield more accurate predictions of the occurrence of specific actions. The key to increasing predictive power appears to be linked to the specificity of both the attitude measured and the behavior observed. Intentionality refers to including some measure of the respondent's intention to take the behavior of interest (Crano and Messe 1982). Extensive work by Fishbein and Ajzen (1975) has shown that information about the respondent's intentions to act can increase the ability to predict behavior. Hwang et al. (2000) provided some evidence that measuring intentions can indeed help predict whether learners will demonstrate environmentally responsible behavior. Ambiguity refers to the respondent's personal experience with people, objects, or events in the behavioral setting (Crano and Messe 1982). Direct personal experience reduces ambiguity and thus increases the likelihood that expressions of attitude about a particular behavior will have predictive power. For example, direct experience with aquatic environmental issues like water pollution and habitat loss would be expected to reduce ambiguity in attitudes toward those issues. This relationship should be explored in stewardship program evaluations.

Level refers to the centrality of beliefs associated with a given attitude (Crano and Messe 1982). Central beliefs are more likely to influence behavior than are attitudes based on beliefs that are more peripheral. Central beliefs (and values) also are long lasting and difficult to change through education programs. Though stewardship education programs are not designed to change central beliefs, program evaluators can understand more about participants' attitudes and behavior if they make some effort to assess participant belief systems.

Vested interest refers to the extent to which a person perceives an opinion to be associated with his or her well-being. The greater the perceived vested interest of one's opinion, the stronger the link between that opinion and one's overt action (Crano and Messe 1982). For example, one would expect that a child's attitudes about an environmental issue on a local water body are more likely to influence and predict her behavior on or around that water body if she has a vested interest in that resource (e.g., if she is aware that her drinking water comes from that source, or if she values that water body as a personal boating or fishing destination).

Self-monitoring refers to the extent to which a person uses feedback from the social context as an indicant of the appropriateness of his or her actions (Crano and Messe 1982). This is a personality trait that varies by individual. Instruments have been developed to assess this trait, but it may not be subject to direct influence through stewardship education programs.

Shapiro (1994) noted four requirements for attitudes to influence behaviors. Attitudes must be:

- Available (i.e., the subject possesses an attitude)
- Perceived as relevant to the behavior
- Accessible (i.e., attitude must come to mind when making decision about behavior)
- Actually used to make the decision.

Shapiro believed that most environmental educators and researchers at that time had concentrated primarily on availability, on giving knowledge that leads to the availability of attitudes. He agreed with Gray et al. (1985) that more research was needed to identify which specific attitudes actually determine behavior, which attitudes are likely to be used in a given situation, and what influences the attitudes that are used.

Develop Better Indicators of Program Outcome Behavior Change

Behavioral indicators of aquatic stewardship may range from simple verbal expressions of awareness of fisheries biology concepts, to enduring and complex expressions of commitment to aquatic resources. If stewardship behavior is the desired outcome of a program, those indicators involving the long-term demonstration of desirable behaviors offer the best evidence of successful programming (Matthews & Riley 1995).

There are many potential behavioral indicators of an internalized stewardship ethic. Deep involvement in the culture and social world related to fishing, and participation in opportunities to have input to fisheries management decisions may indicate an underlying stewardship ethic (Hungerford and Peyton 1980). Other potential indicators include: membership and activity in

environmental organizations, personal decisions regarding family size, volunteer service, political activity, product purchasing and disposal, food consumption patterns, water use and conservation practices, household waste disposal, lawn and garden practices, and energy usage and conservation (Dixon et al. 1995). Choosing a career related to natural resources or the environment may also provide a behavioral indicator of an internalized stewardship ethic. Youth who participate in fishing and boating education programs may demonstrate an internalized stewardship ethic through activities such as catch-and release fishing, cleaning up litter in the places they boat, participating in stream habitat improvement projects, or changing the way they use water at home and school.

It is important to note that evaluation of behavior change should be linked to program goals and program elements oriented toward modifying specified categories of behavior. Evaluation of specific types of behavior change may be inappropriate within the context of a program that had no specific goals related to behavior and contained no specific program elements related to the intended behavioral modification.

Motivations

A long-term goal of environmental education is to develop citizens who make choices and take actions based on an internalized stewardship ethic. If we want to obtain information about the development of a stewardship ethic, information on behavioral motivations will be needed. For example, as evaluators, we might observe a young boater picking up a discarded motor oil container alongside a lake. Clearly this is an appropriate expression of stewardship behavior, but unless we assess her motivations, we will have no indication that a stewardship ethic influenced her action. While it is true the youngster is demonstrating good behavior, she may be doing it because she wanted to impress someone watching her, she'd been told to do it, she was in a competition to see who could pick up the most litter, she wanted something to play with, or any number of other motivations which may be completely unrelated to stewardship.

Assessing motivation is a complex process, but may be guided by the use of an appropriate theoretical model (Deci and Ryan 1985). Stewardship behaviors may be internally or externally motivated. External motivations include financial, legal or normative (peer/social pressure, community norms, etc.) incentives and disincentives. Externally motivated actions are motivated by a desire to avoid a consequence/penalty or gain a reward. Awareness, knowledge, values and ethics may serve as internal motivators. Measures of stewardship motivation have focused on both external and internal sources, including: key values and beliefs, perceived responsibilities, awareness and knowledge, expected environmental benefits, legal sanctions, time and money penalties, information sources, locus of control, and environmental concern (Dixon et al. 1995).

Intentions

Stewardship intentions are "the extent to which people express commitment to responsible stewardship" (Dixon et al. 1995:27). Frequently, intentions are measured by assessing "individuals' willingness to devote money, time, or political support" (Dixon et al. 1995:27). Hines et al. (1987) developed a model of factors that influence responsible environmental behavior based on a synthesis of 128 studies of attitude and behavior change related to the environment. In addition to the requisite knowledge, attitudes and action skills, Hines et al. (1987) included a number of personality factors leading to the intention or desire to act. These include attitudes toward the environment and toward taking action, locus of control, and personal responsibility.

Establish Long-term Evaluation Projects That Include Experimental Designs

As noted earlier, evaluation of environmental education programs generally and stewardship programs specifically remains the exception rather than the rule. Moreover, when evaluation is conducted it tends to be for administrative purposes and it generally examines programs "as is." Practical constraints make it very difficult to use an experimental or quasi-experimental research design. For example, the researcher generally does not have the opportunity to manipulate variables like teacher training, curriculum materials, or field experiences. It is rarely possible for the researcher to randomly assign program participants to treatment groups or to create different treatment groups a priori. Such constraints are to be expected, but they represent a major impediment to the advancement of knowledge about effective program design. To overcome this impediment, leaders in the field of stewardship education should take steps to establish a few long-term research projects designed explicitly to explore research questions. These pilot projects should establish funding for multi-year evaluation that utilizes experimental or quasi-experimental research designs (e.g., random assignment of youth to treatment groups; experimental manipulation of program content).

Develop Authentic Assessment Procedures

The prospect of outcome evaluation may conjure an image of standardized testing procedures. However, the author encourages stewardship educators to consider developing authentic assessment procedures as an alternative and supplemental set of approaches to assessing knowledge and skills gains in formal and informal learning settings. Moorcroft et al. (2000) identify several useful approaches, including portfolio assessment (i.e., an assessment of student-developed materials collected at regular intervals over an extended period of time) and essay assessment (i.e., posing a complex question or set of simpler nested questions that prompt the student to explore various aspects of a topic), and performance assessment (i.e., various techniques that prompt the student to apply knowledge and skills in a realistic setting or situation). These approaches to evaluation are time consuming and can be expensive to implement. However, authentic assessment will allow the evaluator to: 1) document changes in skill and knowledge for individual learners; 2) identify program areas in need of improvement; and 3) verify notions of what students will learn from various program experiences (Moorcroft et al. 2000).

Summary

The ultimate aim of ethics-based stewardship education is "observable change in behavior that is due to internal motivations based on ethics" (Matthews and Riley 1995:10). The best indication that a program is successfully producing intended behavioral outcomes is a quantitative assessment that shows youth who participate in a program have a higher propensity than other youth to express specific desired behaviors. Outcome evaluation of stewardship education programs should include measurements of program participant behavior after it is clearly demonstrated that program design, implementation, and longevity are sufficient to expect particular behavioral changes.

Although behavioral assessment provides the best information about achievement of behavioral program goals, it is not always appropriate or practical to measure changes in participant behavior (for example, some types of desired behavior change may not be expressed until years after programmatic intervention). Early outcome evaluation should focus on attitude research as a key to understanding whether progress is being made toward laying the groundwork for behavior change in program participants. For purposes of evaluation, the researcher should take an approach that uses a comprehensive definition of attitudes, such as that developed by Fishbein and Ajzen (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980). Changes in the cognitive, affective, and conative components of attitudes should all be explored. In other words, evaluation should examine outcomes such as change in knowledge, understanding, opinions, motivations, and behavioral intent.

The relationship between attitudes and behavior is complex and evaluations must be designed and interpreted carefully to provide useful insights on the likelihood of desired behavior changes in program participants. However, recent research has shown that attitude research can help us understand more about the potential influences of programs on behavior if the evaluator takes care to consider the potential influence of an identified set of social, psychological, and situational variables.

As an overall recommendation, the author urges stewardship education professionals to take a comprehensive approach to evaluation. That is, detailed formative evaluation should precede any summative assessments. A comprehensive approach allows one to answer four questions: 1) Was the underlying program model faulty? 2) Was the implementation of the program model appropriate and carried out as prescribed? 3) Were expectations of outcomes/impacts unrealistic, therefore unattainable? 4) Was the evaluation itself adequate in terms of methods, impact indicators examined, people contacted, etc. to obtain valid, reliable, and programmatically meaningful information? (Decker 1988:19). A technique known as evaluability assessment was recommended to address parts 1-3 of comprehensive evaluation. Several common deficiencies in stewardship program evaluations were described. To address these deficiencies the author recommends that leaders in this field: 1) develop better indicators of program outcomes (e.g., knowledge gains, attitude change, behavioral intent, behavioral expression); and 2) take steps to establish a few long-term research projects designed explicitly to explore research questions utilizing experimental or quasi-experimental research designs.

Future Research

The following are recommendations for a research agenda that can advance design and implementation of stewardship education programs by filling gaps in information about best practices. These recommendations represent the author's sense of the type of research needed to address the highest priority information needs. The recommendations offered here are broad in scope and include some methodological consideration that the author believes will advance understanding of best practices. They reiterate points made earlier.

- Conduct a national assessment to identify long-term stewardship programs that: address entry-level, ownership-level, and empowerment-level variables;

- include social support and apprenticeship experiences for learners and integrate formal and nonformal learning situations. Programs identified should serve as the focus of additional research.
- Conduct detailed evaluability assessments of programs identified in the process described above. Programs that are found to have a high level of implementation fidelity should be selected for long-term outcome evaluation.
- Create program treatment groups solely for research purposes (i.e., create groups specifically for research purposes). Randomly assign program participants to treatment groups and create conditions under which the researcher can manipulate the characteristics of the program for each treatment group. Use experimental or quasi-experimental study designs to explore the relationship between program elements and desired program outcomes.
- Design studies that utilize behavioral observation and authentic assessment to measure changes in learner knowledge, attitudes, and behaviors.
- Create longitudinal studies to track changes over time for cohorts of program participants.
- Conduct basic research to develop valid and reliable indicators of program influences on attitudes, motivations, perceived stewardship responsibilities, behavioral intentions, and behaviors.
- Employ social psychological and educational theory to guide research on the relationship between knowledge, attitudes, intentions, and environmentally responsible behavior.
- Conduct additional research on incentives and disincentives to engage in stewardship behaviors.
- Use longitudinal studies to examine how stewardship apprenticeship experiences influence expression of environmentally responsible behaviors.

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Elements of Effective Environmental Education Programs

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"We can all continue to say we are only churchmen, or only educators, or only students, or only government people – that our role is limited, and that we cannot be expected to solve the problems of the world. But . . . some of us had better choose to define ourselves as world problem solvers if world problems are going to be solved" (Theobald, 1970).

Abstract – While said more than 30 years ago, the importance of this statement has not lessened. Amidst numerous, growing and complex environmental problems, the need for the preparation of world problem solvers is as great as ever (Wisconsin DPI, 1994). Environmental educators have globally accepted this role of preparing students to become critical thinkers, informed decision-makers and able communicators – a role that exceeds far beyond presenting information. Environmental education helps learners achieve environmental literacy, which has attitude and behavior components in addition to a knowledge component. Thus, the goal of environmental education is to instill in learners knowledge about the environment, positive attitudes toward the environment, competency in citizen action skills, and a sense of empowerment.

Environmental literacy depends on a personal commitment and motivation to help ensure environmental quality and quality of life. This commitment and motivation often begins with an awareness of one's immediate surroundings. Environmental educators can help foster learners' innate curiosity and enthusiasm, providing them with continuing opportunities to explore their environment and engaging them in direct discovery of the world around them. As learners develop and apply analysis and action skills, as they have the opportunity to make their own decisions and think more critically about their choices and as they hear stories of success, they are learning that what they do individually and in groups can make a difference. This locus of control, or sense that they have the ability to influence the outcome of a situation, is important in helping learners develop a sense of empowerment and a sense of personal responsibility – further key aspects of environmental education.

In order to reach this goal of environmental literacy, environmental education programs must be effective. Effective environmental education programs are relevant to the mission of the agency or organization, to the educational objectives of the audience, and to the everyday lives of the individual learners. They involve stakeholders in all stages of the program, from the development of the program to its evaluation. Effective programs empower learners with skills to help prevent and address environmental issues and with a sense of personal and civic responsibility. Further, they are accurate and balanced, incorporating multiple perspectives and interdisciplinary aspects. Effective environmental education programs are instructionally sound, using "best practices" in education. And finally, effective programs are evaluated with appropriate tools.

Background and Setting

Amidst numerous, growing and complex environmental problems, the need for the preparation of world problem solvers is as great as ever (Wisconsin DPI, 1994). Educators have globally accepted this role of preparing students to become critical thinkers, informed decision-makers and able communicators. In virtually every country "there is a frantic haste to develop programs in environmental education" (Wisconsin DPI, 1994, p. 10).

The roots of this environmental education movement extend back to the nature study movement, with leaders such as John Muir and Enos Mills and their study of the natural history of plants and animals. In 1891, Wilbur Jackman wrote *Nature Study for the Common Schools*, which aimed to educate urban dwellers who had lost touch with the natural world (Disinger, 1993). In 1896, a junior naturalist program associated with Cornell University taught students about the natural world in the context of understanding rural agriculture. In the early 1900s, Anna Comstock compiled the monthly newsletters from this junior naturalist program. The resulting book, *The Handbook of Nature Study*, was finished in 1911 and used for teaching natural history. The nature study movement contributed some of the early ideals for education that are still im-

portant today in elementary science education – inquiry and discovery with first-hand observation.

The conservation education movement began in response to the soil erosion, dust storms and flooding disasters of the 1930s. Initiated by resource management agencies, the goal of conservation education was to awaken Americans to the importance of conserving various natural resources. Forester Aldo Leopold gained national fame during this era and significantly influenced the movement through his passionate essays and provocative theories. Legislation was passed giving schools land designated for nature purposes. In addition, camps sponsored by churches and agencies, such as the YMCA, used recreation to help promote an understanding of the natural world. At the same time, the progressive education movement surfaced. Led by John Dewey, the focus of progressive education was "learning by doing," incorporating learning about the environment while in the environment (Disinger and Monroe, 1994).

The 1950s gave rise to outdoor education, with its sole specification of the place for learning – outside the school building. Outdoor education was described by L.B. Sharp, who wrote, "That which can best be learned inside the classroom should be learned there; and that which can best be learned through direct experience outside the classroom, in contact with native materials and life situations, should there be learned" (1947, p. 43). This movement was in response to concerns that urban youth were not experiencing direct contact with the natural environment. Teachers were encouraged to teach many different subjects in the outdoors, giving students this opportunity.

Through the nuclear testing of the 1950s and Rachel Carson's book, Silent Spring (1962), people began to notice the impact on the environment by "unseen forces," such as nuclear fallout and modern agricultural practices (Younger, 1995, p. 4). During the 1960s and into the early 1970s, the environmental movement contributed a human aspect to the evolution of environmental education, helping people realize the impact humans have on the natural and built environment. The 1970 Earth Day celebrations were "a landmark expression of public support for a realignment of values and a new respect for the environment" (Disinger and Monroe, 1994, p. 11). This set the stage for the transition of education *about* the environment and *in* the environment to education *for* the environment.

In 1972, the United Nations Conference on the Human Environment, held in Stockholm, Sweden, recommended the establishment of environmental education programs on an international level. Following this recommendation, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) sponsored a series of international environmental education workshops and conferences. United Nations representatives met in the former Yugoslavia in 1975 to define environmental education and establish its basic objectives. The Belgrade Charter was adopted at this conference, providing a widely accepted goal statement for environmental education (NAAEE, 1996). It states: "*The goal of environmental education is to develop a world population that is aware of, and concerned about, the total environment and its associated problems, and which has the knowledge, attitudes, skills, motivation, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones*" (UNESCO-UNEP, 1976).

In 1977, representatives from 66 member nations and observers from two nonmember nations gathered for the world's first intergovernmental conference on environmental education. This conference, held in Tbilisi in the former Soviet Republic of Georgia, led to the release of an official statement on environmental education - the Tbilisi Declaration. Built on the Belgrade Charter, the Tbilisi Declaration acclaimed "the important role of environmental education in the preservation and improvement of the world's environment, as well as in the sound and balanced development of the world's communities" (Wisconsin DPI, 1994, p. 157).

In addition to establishing overall goals of environmental education, the Tbilisi Declaration established the following objectives of environmental education:

- *Awareness* – to acquire an awareness and sensitivity to the total environment and its allied problems;
- *Knowledge* – to gain a variety of experiences in and acquire a basic understanding of, the environment and its associated problems;
- *Attitudes* – to acquire a set of values and feelings of concern for the environment and motivation for actively participating in environmental improvement and protection;
- *Skills* – to acquire the skills for identifying and solving environmental problems; and
- *Participation* – to encourage citizens to be actively involved at all levels in working toward resolution of environmental problems (UNESCO, 1978).

The Tbilisi Declaration constitutes the framework, principles and guidelines for environmental education at all geographical levels – local through international – and for all age groups, both inside and outside the formal school system (Wisconsin DPI, 1994). The Belgrade Charter and the Tbilisi Declaration are con-

sidered founding documents of the field and provide the foundation for much of what has been done in the field since 1978 (NAAEE, 1996). More recently, the 1987 Brundtland Commission and the 1992 United Nations Conference on Environment and Development have influenced environmental education at an international level.

The passing of the National Environmental Education Act of 1970 in the United States reflected a national commitment to environmental education. This act stated that environmental education "is intended to promote among citizens the awareness and understanding of the environment, our relationship to it, and the concern and responsible action necessary to assure our survival and to improve the quality of life" (qtd. in Ford, 1981, p. 14). The 1990 National Environmental Education Act reaffirms the purpose of the earlier act. It also focuses on schools as the place for effective environmental education, while recognizing the importance of non-formal avenues for educating citizens, communities and the workforce (Disinger and Monroe, 1994).

In summary, environmental education is not the presentation of information. Environmental education helps learners achieve environmental literacy, which has attitude and behavior components in addition to a knowledge component. Thus, the goal of environmental education is to instill in learners knowledge about the environment, positive attitudes toward the environment, competency in citizen action skills, and a sense of empowerment (Disinger and Monroe, 1994). Further, while the audience is often youth, environmental education is intended for all – youth and adults, as well as individuals and organized groups.

Elements of Effective Environmental Education Programs

- Effective environmental education programs are relevant to the mission of the agency or organization, to the educational objectives of the audience, and to the everyday lives of the individual learners.

Good environmental education programs are relevant – relevant to the agency or organization, relevant to the audience and meaningful to their everyday lives. An agency or organization's mission and environmental priorities provide direction for program development in environmental education, guiding the development of goals and objects and their choice of target audience. Tying environmental education programs to the agency or organization's primary purpose helps focus program development and justify funding, prevent the establishment of generic environmental education programs, and aid in program efficiency and sustainability.

However, it is not enough for an agency or organization to consider only its mission or purpose. Environmental education programs are often distinguished from informative or interpretive programs, as they have objectives beyond information dispersal and involve working with an audience that often has pre-defined learning objectives. A school group, for example, has pre-defined learning objectives in the form of a curriculum – what teachers will teach, the order in which concepts should be covered, and expected knowledge and skills. A scout group would also have learning objectives, which might take the form of earning badges or patches. The key to relevant environmental education programs is finding commonalities among the existing learning objectives and the agencies or organization's mission and priorities. By doing so, the needs of both the provider (the agency or organization) and the audience are met. Teachers or leaders of the groups that will be participating in the program can often help find these commonalities by providing and explaining materials that offer learning objectives (state standards/benchmarks or badge requirements, for example).

Effective environmental education programs and materials need to present information and ideas in a way that is relevant to the learners (NAAEE, 1996). For example, a program on endangered species would be more relevant to students in Florida if the manatee were used as an example, rather than the Siberian tiger. This need for relevance stems from children's cognitive development, as they develop the ability to think concretely before they can think abstractly. When programs move beyond what is relevant and meaningful, learners don't have the chance to build their learning on what they already know - learning becomes too abstract.

Thus, content is more effectively conveyed when embedded in a local context, giving learners a chance to explore and experience what's around them. The sensitivity, knowledge and skills needed for this local connection provide a base for moving out into larger systems, broader issues and an expanding understanding of causes, connections and consequences (NAAEE, 1999). Likewise, skill building and application must be couched within the context of solving real problems – problems that directly affect learners either at home, at school or in their community. When environmental education is taught in the place where they live and through authentic situations, a learner's own experiences become a part of their education.

Enjoyable learning experiences also help make programs more relevant to the learners. Many environmental educators realize the value of learners having direct contact with nature. Daniel Kriesberg, in *A Sense of Place*, writes, "They need to be outside. They need to explore, get dirty, find stuff – they need to have fun" (1999, p. xiv). The problem, explains Kriesberg, is that many learners don't have these opportunities. Small bits of wild places where kids can explore are disappearing and time to visit them becomes more and more rare, resulting in the "extinction of experience." Thus, environmental educators need to reintroduce learners to their local area by exploring and experiencing it, by learning about it and celebrating it. By doing so, environmental educators help learners develop a sense of wonder and a sense of place, fostering the awareness and appreciation that motivate them to further questioning, better understanding, and appropriate concern and action. (While enjoyable experiences in nature are one way to launch an environmental education program, it is not the only way. Learners in a central city environment, for example, may become interested in the environment through efforts to clean up a toxic waste site because it is damaging their water supply.)

- Effective environmental education programs involve stakeholders in all stages of the program, from the development of the program to its evaluation.

Successful programs bring a coalition of stakeholders together to design, implement and evaluate a program that meets their needs (Monroe, 1999). Stakeholders are those that have a stake in the program that is developed. They are they people who care about a program, are willing to develop a commitment to it and are best able to offer input into it. These stakeholders might be teachers, funders, agency supervisors, community leaders, landowners, extension workers, parents, and curriculum developers.

While it would be impractical to consult a large number of stakeholders on every decision, their input and participation is essential in the beginning stages (Monroe, 1999). Their participation lends a variety of perspectives to the program, shaping the program focus and audience. Their participation also helps achieve buy-in early in the process, so that as the program is developed, it is more likely to be used. Another advantage of using stakeholders is that it reinforces the image of community partnership and/or ownership and interest in the program. Stakeholders are also important during the evaluation phases of the program, as they can offer input about what information to gather, how to gather it and ultimately how to share it with important audiences.

While this stakeholder approach can seem cumbersome, most organizations using a stakeholder approach believe the strengths outweigh the extra time and effort needed to manage the process. Organizations using this approach have found several things helpful. In developing a team of stakeholders, think about who will be the ultimate users of the results and try to structure your team so that the results are channeled directly to those end-user groups. After identifying which groups should be represented on your team of stakeholders, select who, specifically, should represent each group on the team. Select team members who are enthusiastic, willing to represent his or her group, willing to commit to the project and those who have opinions but not "axes to grind." Strive for diversity among team members, not limiting members to those holding formal leadership positions within their groups or those that are the "most involved" or "best" (most involved teachers, for example).

Once a stakeholder team is established, communication is key. Responsibilities need to be clarified early and often through multiple modes of communication. Make sure your team knows they are acting in an advisory capacity and not in a decision-making capacity. Work with the team to identify rules and roles for smooth and effective operation. Group facilitation skills can also aid in effective stakeholder team operation. (Dr. Emmalou Norland at Ohio State University provided these guidelines to National Park Service employees utilizing the stakeholder approach in the development of education programs.)

- Effective environmental education programs empower learners with skills to help prevent and address environmental issues and with a sense of personal and civic responsibility.

Awareness and knowledge of environmental processes and systems play an important role in environmental education. But awareness and knowledge alone do not make a program an environmental education program. And when considering the goal of environmental education (environmental literacy and its accompanying responsible environmental behavior), research shows that knowledge and attitudes are not the only variables at play. While knowledge and attitudes alone don't help or harm the environment, human behaviors do. Behaviors, of course, are supported by knowledge and attitudes, but there is not a direct cause- and effect- progression from knowledge to attitude to behavior, as educators have long believed (Day, 1999).

How can educators help learners behave in environmentally responsible ways?

Some have turned to environmental communication techniques and social marketing theories to successfully address behavior change. School-based environmental education, however, differs from environmental communications and social marketing in that it doesn't always directly target specific behaviors, particularly in the context of controversial issues (Monroe, Day and Grieser, 2000). Instead, environmental education attempts to teach students "how to think" and not "what to think." Rather than directing learners in a specific course of behavior, environmental education helps learners form the capacity to collect and analyze information, make informed decisions, and participate fully in civic life (Monroe, Day and Grieser, 2000).

This requires more than the awareness and knowledge of environmental processes and systems and positive attitudes toward the environment; it requires procedural knowledge of how to affect change and the competency in citizen action skills needed to participate fully in civic life. Educators can help develop this procedural knowledge and competency in citizen action skills by providing opportunities to define an issue, determine if action is warranted, identify others involved in the issues, select appropriate action strategies, create and evaluate an action plan, implement the plan and evaluate the results (NAAEE, 1996). Educators can also provide opportunities to build skills in oral and written communication, conflict resolution, and leadership and opportunities to participate in the political or regulatory process, consumer action, and community service.

Thus, environmental education involves a learning progression from awareness to action, a progression mirrored in the objectives set forth by the Tbilisi Declaration described above. Environmental literacy depends on a personal commitment and motivation to help ensure environmental quality and quality of life (NAAEE, 1999). This commitment and motivation often begins with an awareness of one's immediate surroundings. Environmental educators can help foster learners' innate curiosity and enthusiasm, providing them with continuing opportunities to explore their environment and engaging them in direct discovery of the world around them (NAAEE, 1999). Furthermore, this learning progression is not necessarily linear nor is it hierarchical. As learners develop and apply analysis and action skills, as they have the opportunity to make their own decisions and think more critically about their choices and as they hear stories of success, they are learning that what they do individually and in groups can make a difference (NAAEE, 1999). This locus of control, or sense that they have the ability to influence the outcome of a situation, is important in helping learners develop a sense of empowerment and a sense of personal responsibility – further key aspects of environmental education.

- Effective environmental education programs are accurate and balanced, incorporating multiple perspectives and interdisciplinary aspects.

Environmental education has been criticized by a number of groups and individuals for lacking credibility and accuracy. A book by Michael Sanera and Jane Shaw, *Facts Not Fear: A Parent's Guide to Teaching Children About the Environment* (1996), has played a central role in this challenge. Children, according to this book, are being scared by misinformation presented by their teachers and textbooks. Katherine Kersten, chair of the Center of the American Experiment in Minneapolis, Minnesota, echoes this concern describing environmental education as resulting in a "we're all going to die" sense of hopelessness (in Menzies, 1997). Kersten states, "These days, facts frequently take a back seat in the environmental education . . . Too often environmental instruction seems to aim . . . at convincing children that the planet is in imminent danger, and they must save it" (qtd. in Menzies, 1997, p. 3).

In April 1997, the Independent Commission on Environmental Education released their assessment on environmental education materials, "Are We Building Environmental Literacy?" Sponsored by the George C. Marshall Institute, the Commission reviewed approximately 70 different resources for science and environmental education, including science textbooks and curricula produced by non-profit agencies, government agencies, and private individuals. This assessment, too, challenges the credibility of some environmental education materials, primarily with regard to the treatment of controversial issues.

In response to this wave of criticism, the National Environmental Education and Training Foundation (NEETF) prepared a briefing report. The report states, "Children and adults receive messages about the environment from many places – television, movies, books, newspapers, and magazines. The message may be about the environment, but Environmental Education, as practiced by concerned professionals, is very different from casual information or advocacy to promote a particular point of view" (1997, p. 1).

This report outlines the "facts" concerning environmental education. Environmental educators, according to this report, are advocates for balanced and scientifically accurate education. Guidelines estab-

lished by the North American Association for Environmental Education (NAAEE, 1996) help ensure this balance and accuracy. The report cites characteristics for environmental education that are recommended by the NAAEE's *Environmental Education Materials: Guidelines for Excellence* (1996):

- factual accuracy – materials should reflect sound theories and well-documented facts;
- balanced presentation of differing viewpoints and theories – differences of opinion and competing scientific explanations should be presented in a balanced way; and
- openness to inquiry – materials should encourage students to explore different perspectives and form their own opinions (qtd. in NEETF, 1997, p. 2).

Their report further states that environmental education promotes quality education and effective teaching across the disciplines. Environmental education, according to the briefing report, can help schools accomplish the eight national education goals of the Educate America Act of 1994 (NEETF, 1997). The National Environmental Education and Training Foundation cites a report by the State Education and Environment Roundtable, in San Diego, California, which evaluated environmental education programs in 41 schools across 12 states. This report found environmental education programs increasing students' knowledge of the natural sciences, language arts, mathematics, and social sciences. In addition, over seventy-five percent of the schools evaluated reported increases in grade averages and standardized test scores (NEETF, 1997).

Pam Landers, project manager for the Environmental Education Teacher Preparation Project in Minnesota, has responded to the criticism surrounding environmental education in a similar manner, distinguishing environmental education from casual information and pure advocacy. Education, according to Landers, "should enable people to act intelligently, with some measure of independent thinking. People are not able to think and act intelligently "if they have been merely conditioned or coerced" (Landers, 1997, p. 5). Environmental education helps facilitate a student's ability "to make decisions, solve problems and conduct inquiries, using reading, communications, science, math and other skills as tools" (Landers, 1997, p. 5).

This recent opposition has prompted environmental educators to take a closer look at the validity, relevancy and accuracy of the field's materials and methods. The reports, books and newspaper articles challenging the credibility of environmental education are helping insure that the delivery of environmental education continues to be high quality education. While there generally is consensus in the field for this balanced approach prescribed by NAAEE, some environmental educators believe taking more of an advocacy approach is warranted when educating *for* the environment.

In some situations, it may be appropriate to take a less balanced, but still scientifically accurate approach. For example, it is appropriate for teachers to enforce socially accepted behaviors, such as no kicking or no cheating in class. By the same token, it may be justifiable for agencies to provide an unbalanced approach to socially accepted behaviors in areas such as boating safety, endangered species protection, and aquatic habitat improvement. But when educational messages drift to uncertain waters, such as pollution sources, private property rights or other controversial areas, agencies may be wise to avoid an advocacy message and instead revert to presenting multiple views and perspectives. Another example of when it may be appropriate to take a less balanced approach is when urgent and specific behavior change is needed or when the target audience is adults who have chosen to participate in the program. However, these situations perhaps may be viewed more accurately as using environmental communications or social marketing, rather than "true" environmental education.

- Effective environmental education programs are instructionally sound, using "best practices" in education.

According to the Wisconsin Department of Instruction, educational programs and curricula should be developed in response to theories of learning, such as Piaget's theory of cognitive development, constructivism, multiple intelligences, and learning styles (1994). In order for environmental education programs to be effective in an educational sense, they must also be congruent with the way people learn. The following are descriptions of theories of learning and their implications, which can guide curriculum planning, program development and methodology in environmental education.

Piaget's Cognitive Development Theory

Until about the 1930s, children were considered to be miniature adults intellectually; children differed from adults only in the quantity of knowledge they had acquired (Gormly and Brodzinsky, 1989). Through research by Piaget and others, it became clear that children think and learn in ways that are different from adults. As children develop, they reorganize and re-

construct their base of knowledge, replacing one set of assumptions with another.

Piaget identified four cognitive stages through which an individual may progress from birth through adolescence: sensorimotor, preoperational, concrete operation and formal operational. This sequence is invariantly ordered, and some refer to these stages, respectively, as the active child, the intuitive student, the practical student, and the reflective student. Development is associated with the passage from one stage of operation to another and is a function of experience and maturation (Joyce and Weil, 1996).

Piaget's theory implies that instructional methods and content need to be consistent with how students develop cognitively, as children cannot "learn" if they cannot understand what they are being asked to learn (Wisconsin DPI, 1994). Real knowledge, according to Piaget, can only occur when the task is useful to the student and when the student is psychologically ready (Joyce and Weil, 1996). Teaching, then, is the act of creating environments that allow for students' cognitive structures to change and emerge – environments that provide for learning opportunities at a level just above a student's current cognitive level. Many programs provide learners with choices, as learner tend to choose learning experiences appropriate for their cognitive structures. Applied to environmental education, curricula should be developed so that they facilitate stage-relevant thinking and allow students to discover for themselves the logical connections between object or events (Joyce and Weil, 1996). A further implication is for students to have many opportunities to explore the natural world and think about it within their various stages of intellectual development (Caine and Caine, 1990).

Constructivism

For most of this century, behaviorism has driven educational practice. This model of learning assumes that students are a blank slate on which the knowledge of others is simply written. Research since the mid-1970s has led to a new model – constructivism. Jean Piaget was an early supporter of constructivism, believing strongly that learning occurs as a result of dynamic interactions between individuals and physical and social environments (Wisconsin DPI, 1994). Thus, rather than being directly transmitted from teachers and books to students, knowledge is actively constructed from students actions in the environment (Wisconsin DPI, 1994). According to Piaget, the development of knowledge is a process of continual construction and reorganization (Yager, 1991).

Another key tenet of constructivism is the interplay between newly constructed knowledge and the learner's prior knowledge (Knapp, 1996). Ausubel et al. (1978) stated that the most important factor influencing learning is what the learner already knows. Learning occurs by "actively constructing knowledge, weighing new information against . . . previous understanding, thinking about and working through discrepancies . . . and coming to a new understanding" (O'Neil, 1992, p. 4). Learning can occur only when the new idea or concept can be integrated into the learner's existing conceptual system. Thus, the context of learning is important, as the situation must be both somewhat familiar and somewhat new. When the learner cannot integrate the new material with previous knowledge, rote learning occurs (McClelland, 1982).

For educators, constructivism implies that instructional methods need to be consistent with how students construct knowledge and that the context or content must be relevant. Clough and Wood-Robinson (1985) agree, arguing that classroom learning would be improved if teachers could build upon the learners' ideas rather than ignore them. Their research suggests that students "have a great deal of knowledge about a subject from out-of-school sources" (1985, p. 129). Teachers, according to this research, should draw preexisting knowledge into the classroom, using what learners already know and what is familiar to them as a basis for knowledge restructuring.

Anderson (1987) describes a three-stage process that can be used when teaching for conceptual change. In the first, or preparation, phase, learners "begin to think about the phenomena that will be explained in the unit, discuss their own explanations, and become aware of the limitations of their naïve explanations" (Anderson, 1987, p. 85). This stage is followed by a presentation phase, in which teachers explain key principles and theories. The final stage is application and integration. In this stage, learners apply the scientific principles to new phenomena and integrate those principles and theories into their personal knowledge.

These implications translate into elements useful to environmental education – programs that are learner-centered and involve active learning. In other words, environmental education is something students do, not something that is done to them. These aspects are at the heart of experiential education, a methodology that closely parallels constructivism. A central tenet of experiential education is that learning is an active process, occurring when experiences build upon previous experiences in a positive way and incorporate interaction between the learner and the environment (Anderson, 1987). Experiential education drives several specific instructional methods, including service learning,

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problem- or project-based learning, and field-based instruction. These methods are proving to be quite effective in environmental education and hold promise for motivating students and improving student learning and academic performance.

Constructivism also supports cooperative learning. Cooperative learning is a teaching strategy that allows learners to work in small groups to explore a new idea, gather information, discuss ideas, apply concepts and solve a problem (Monroe, 1999). Research has also shown that cooperative learning is an effective instructional approach for student achievement in reading, math, science and thinking skills (Lazarowitz and Karsenty, 1990; Slavin, 1994). Research by Solomon (1990), Nastasi and Clements (1991) and Lazarowitz and Karsenty (1990) has also shown that cooperative learning has positive effects on students' social skills and interactions with their peers. By incorporating cooperative learning into environmental education programs, students have the opportunity to gain communication skills, leadership skills and the ability to work with others – all of which are important aspects of environmental literacy (Monroe, 1999).

Gardner's Theory of Multiple Intelligences and McCarthy's Research on Learning Styles

Howard Gardner's theory outlines seven ways of recognizing a person's intellect. They are: visual-spatial, bodily-kinesthetic, musical, logical-mathematical, verbal-linguistic, interpersonal, and intrapersonal (Armstrong, 1994 qtd. in Knapp, 1996). According to Gardner, the main value of his theory is that it helps educators acknowledge differences in how students learn (Knapp, 1996). His theory of multiple intelligences is related to research on learning styles by McCarthy, who describes four major learning styles (1980).

One of the four learning styles is the imaginative learning style. Imaginative learners perceive information concretely and process it reflectively. Learning occurs through listening and sharing ideas, and the imaginative learner functions through social interaction. Analytic learners, the second type, perceive information abstractly and process it reflectively. An analytic learner prefers sequential thinking, need details and value what experts have to offer. The third type, common sense learners, perceives information abstractly and processes it actively. Common sense learners are practical and enjoy hands-on learning, looking for immediate use of what is being learned. Finally, dynamic learners perceive information concretely and process it actively. Dynamic learners learn by trial and error and self-discovery, being excited by anything that is new.

McCarthy's multiple learning styles research and Gardner's theory of multiple intelligences remind educators that not all students learn and respond to learning situations in the same way. Further, intelligence is not a fixed or static reality; it can be learned, taught and developed. Their research has important implications for those who develop and implement environmental education programs. The content, teaching methods and assessment used in an environmental education program should allow for the expression of multiple intelligences, allowing students multiple ways of learning and showing what they know and can do. Further, content should be presented using a variety of teaching strategies (groups, physical activity, artistic variations, etc.), providing students with the opportunities to express their learning styles and their auditory, visual, tactile and kinesthetic preferences for receiving information.

- Effective environmental education programs are evaluated with appropriate tools.

Program evaluation was born during the period of large-scale social programs and government intervention of the 1960s and 1970s (Patton, 1997). Program evaluation focused on guiding funding decisions, helping determine what was worth funding and what was worth doing. As evaluations were implemented, a new role emerged: increasing overall program effectiveness by guiding improvements to the program (Patton, 1997). Thus, today we think about program evaluation not only in terms of something that is done as or after a program is implemented (summative evaluation), but also as something that is done *throughout* the development and implementation of the program (formative evaluation).

In his book, *Utilization-Focused Evaluation*, Michael Patton provides a useful definition of program evaluation (1997). Patton describes this as the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future programming. This type of evaluation is within contextual boundaries of time, place, values and politics. Central to his definition is meeting the information needs of specific intended users (the stakeholders). Their information needs, that is, their intended uses, focus the evaluation. Care must be taken to incorporate the stakeholders' opinions throughout the evaluation process, as this increases the likelihood that the findings will be used.

Another key aspect is the systematic collection of information about a potentially broad range of topics. Systematic data collection is emphasized as opposed to applying social science methods; program evaluators may use research methods to gather information but they may also use other forms of systematic information that are not research-oriented. While how to define program evaluation is a matter for discussion and negotiation, what is not negotiable is that the evaluation be data-based (Patton, 1997).

These two key aspects provide guidance for environmental education program evaluation. The evaluation should have a purpose and audience (how will the stakeholders use the findings?) and should involve systematic data collection. Determining the purpose for or the focus of the evaluation helps direct how the evaluation process proceeds, including what and how information is collected.

There are a number of tools or methods that can be used to collect information as the program is being developed. Comment or feedback forms, observations, interviews, focus groups, and surveys are examples. When curriculum materials are being developed, feedback by content and pedagogical experts should be a part of the development process. Individual lessons can be pilot tested or the program in its entirety can be field-tested, both of which are critical to developing practical and useful programs or curriculum materials. Information from these methods is used to help improve the program or materials. Information should also be collected after the program is complete to help the program manager make an overall judgment of the value of the program – often for the benefit of some external audience or decision maker. This information helps answer questions such as whether or not it worked, were goals met and should the program be continued.

For environmental educators, changes in knowledge, attitude, intentions, and behaviors of program participants are of interest. While important, designing an assessment to measure these changes is difficult. The questions must be specific enough to target some difference that will be measurable, and enough students must be involved to find significant differences. Further, to measure the impact of the program, one must be able to compare students who participated in the program with students who did not (experimental and control groups), or compare student's knowledge at two different times – before and after the program (pretest/posttest). The *National Park Education Programs: Making a Difference* report offers some suggestions: use both strategies of measuring impact (experimental/control groups and pretest/posttests) to reduce the problems associated with each; assign "equivalent" classes in the same school to be control and experimental; inform teachers of their role in the evaluation process; carefully select teachers and schools to provide a cross-section of reality in the school situation; and accept that there will be some factors that cannot be controlled (Monroe, Washburn, Goodale and Wright, 1997).

Recommendations for Further Research, Discussion and Training

- Research and/or Discussion Relating to Student Academic Achievement

As described in of the previous section, effective environmental education programs need to meet the needs of the audience. In the case of school-based environmental education programs, these needs relate to the educational objectives of schools at the classroom, district, state and national levels. While environmental educators realize the importance of environmental education and its relevance to the daily lives of students, they must also realize that school administrators may not believe it plays a highly relevant role in meeting students' educational needs and objectives. In the midst of school reform, standards and high stakes testing, environmental education may be the last thing on their minds. Thus, environmental educators find themselves having to justify environmental education (sometimes to their own agency or organization, as well as the schools). One way of doing this is demonstrating that environmental education can improve student learning and academic performance – the very goals that school administrators are seeking.

The Environmental Protection Agency acknowledges the need for research relating to environmental education and student learning. In a recent call for proposals (November, 2000), the Environmental Protection Agency is seeking to fund research projects that answer the following questions: To what extent does environmental education improve student academic performance when integrated within various core subjects (such as science, social studies, language arts, etc.)? What specific characteristics of an environmental education program and/or the instructional practices used have the greatest impact on student performance? What are the implications of this research for linking EE with state and national education reform efforts?

These research questions lead to questions for further discussion. Where do the goals of environmental education fit within this fairly recent emphasis on improving student learning? Or is environmental educa-

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tion "selling out" to meet the needs of the formal education community? Not necessarily. Environmental education has much to offer formal education, including a relevant context, engaging topics and "hands-on" opportunities for learning. When the goal of improving student learning is viewed as complementary with building environmental literacy, environmental educators can help the wider education community understand that environmental education is simply good education. This will go a long way in ensuring that, in the midst of education reform and its high-stakes standards and evaluation, environmental education doesn't get lost in the shuffle.

- Research and/or Discussion Relating to Education and Behavior Change

As described in Element C of the previous section, environmental education programs help build skills to prevent and address environmental issues. Preventing and addressing environmental issues brings us into the arena of behavior change and raises the question of how educators can affect behavior change using educational tools alone.

This relates to the long-believed notion that increased knowledge will lead to increased concern, which in turn leads to behavioral change. While knowledge, attitudes and behaviors are related, the relationship is not a simple cause-and-effect progression from knowledge to attitude to behavior, as educators have long believed (Hines, Hungerford and Tomera in Monroe, Day and Grieser, 2000). Further research has indicated that there are a number of variables acting in combination to influence behavioral intentions. Variables most closely correlated with environmentally responsible actions are perceived skill in using action strategies, level of environmental sensitivity, perceived knowledge of action strategies, and locus of control (Sivek and Hungerford, 1990).

A recent article in the Journal of Environmental Education takes this a step further. Researchers at the Seoul National University, Korea found that the variables of locus of control and attitude are more important than knowledge and personal responsibility in terms of the effects on intention to act. Specifically, the core variable "for improving the intention to act for responsible environmental behavior is internal locus of control" (Hwang, Kim and Jeng, 2000, p. 24). The article states further, "if environmental educators want to change or to improve their subjects' intentions to act, it would be effective to use programs and materials that can stimulate internal locus of control" (p. 24). The change of locus of control could be achieved by encouraging people to make their own decisions about problems and critically evaluate the opinions of others and by providing opportunities for people to apply action skills successfully (Newhouse, Hungerford and Volk in Hwang, Kim and Jeng, 2000). Despite these findings, this article still acknowledges that more research, specifically longitudinal, is needed as,"research has not yet satisfactorily identified the knowledge components that are the precursors to responsible environmental behavior" (Sivek and Hungerford in Hwang, Kim and Jeng, 2000, p. 20). This need concurs with a recommendation by Saunders, Hungerford and Volk (1992) for a national longitudinal study of changes in K-12 student behavior and behavior changes of target populations within the general public as a function of environmental education instruction and an investigation of the precursors to responsible environmental behavior within the general public (1992). Further, research has not yet identified how transferable or generalizable skills learned through environmental education are.

While these questions relating to behavior change provide opportunities for further research, they also provide the opportunity for further discussion – the consideration of how other disciplines might contribute to the goal of environmentally responsible behavior. The emerging discipline of social marketing, for example, provides some insight into these questions. Derived from commercial marketing and behavior psychology, social marketing can be used to encourage new behaviors in groups of people. To influence new behaviors, social marketing involves the following steps: identifying the audience and understanding what they perceive to be the barriers and benefits of their behavioral choices; designing a strategy that utilizes behavior change tools, piloting the strategy with a small segment of a community and finally, evaluating the impact of the program once it has been implemented across a community (McKenzie-Mohr and Smith, 1999). In contrast to environmental education's framework of building, knowledge, skills and attitudes to act on behalf of the environment, social marketing raises the possibility that people may change their behavior for motives other than environmental reasons.

Additional Recommendations for Further Research, Discussion and/or Training

1. *Addressing complex environmental issues through environmental education.*

The literature tells us the effective environmental education programs require content and methods that are concrete and relevant to learners. However, how do environmental educators handle the environmental issues that are not concrete and not immediately rele-

vant to the learners? Some have used case studies or success stories to help bridge this gap, making complex issues more relevant or concrete. More discussion and/or research are needed.

2. *Effectively using the stakeholder approach in program development and evaluation.*

The stakeholder approach is valued for reasons identified in Element B above. Multiple stakeholders often result in multiple interests, values and uses, which can sometimes lead to conflict. For example, a stakeholder team may have representatives from the agency, the school, and the community's primary industry and may strongly differ about the goals of the program being developed. Further training and discussion is needed to help those trying to use the stakeholder approach handle conflict among stakeholders.

3. *Professional development for teachers and non-formal educators.*

Although there are some good programs to train pre-service and in-service teachers in environmental education, these programs tend to be inconsistently available. Teachers often express misgivings about their ability to conduct environmental education programs and with outdoor classroom management. Further, many agencies and organizations that have environmental education as part of their missions, but lack the expertise among their staff to develop and implement effective education programs. Further discussion (followed by training measures) is needed to improve the quality and availability of professional development for pre-service and in-service teachers and for future non-formal environmental educators.

4. *Environmental Education and Education Reform.*

Environmental education has the potential to significantly improve the public education system. While initial studies are indicating that the goals of education reform (improved student learning, for example) can be effectively accomplished through environmental education, we do not know if environmental education is a *necessary* condition of improving education. For example, is using the environment as an integrating or motivating context better than using the arts (music, language, art) as the context? Determining that environmental education is indeed a necessary component of improved education can help establish its place in the curriculum, making it less subject to funding priority shifts and more likely to be a focus in teacher training.

1. *Reaching a broader audience.*

Most environmental education efforts target elementary and secondary students. As a result, important audiences – adults, people of color, low-income populations, senior citizens, and businesses, for example - are being missed or inadequately reached. Further research, discussion and training are needed in the area of knowing *how* to engage these audiences and how to adapt traditional teaching strategies to diverse communities and cultures.

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The Right Tools for the Job: How Can Aquatic Resource Education Succeed in the Classroom?

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Abstract – Because of its bases in science and stewardship, aquatic resource education may be seen as a type of environmental education. The range of environmental education (EE) programs includes a huge variety designed for different groups and settings. This chapter takes the perspective of environmental education as it is done in the formal K-12 classroom situation, that is, with intact groups of individuals who are fairly homogeneous in terms of age and experience and have been assembled for the purpose of learning. Within that classroom the educational experiences are constrained by an existing system of practice and by methods of teacher preparation, both ingrained over many decades. What is acceptable to the classroom education system is structured by community mores and often supported inequitably across geographic regions. Change in classroom education comes at a glacial pace, and it is nearly always top-down and assessment-driven.

By its definition, environmental education fosters the development of ecological knowledge, awareness of issues and how to solve them, and motivation to work toward environmental quality. A major goal is to build within learners and intention to act, which is seen as the most dependable precursor to environmentally responsible behavior. Unfortunately, traditional classroom curricula do not encourage, and community mores sometimes do not permit, the kinds of behavioral goals that are key to EE. According to theory and practice, environmental education topics that are appropriate to the curriculum can be infused in the existing curriculum if they are acceptable to teachers. New curriculum restructure in science and geography may offer some opportunities for aquatic resource education. The best EE is interdisciplinary, uses strong science, is implemented using active, cooperative learning, and is extended through service learning or field activities. Getting aquatic resource education into schools through EE can be accomplished by meeting teachers' needs for topics, having excellent curriculum materials, and delivering them through a strong program of teacher education.

Introduction

Environmental education (EE) programs are designed for many groups in many settings. This manuscript is written from the perspective of environmental education as it is done in the formal K-12 classroom situation, that is, with intact groups of individuals who are fairly homogeneous in terms of age and experience and have been assembled for the purpose of learning. It is the classroom environment and its potential with which the author is most familiar, having taught science in middle schools for seven years and designed teacher education programs in EE for nearly 25 years.

My understanding of the components of aquatic resource education (ARE) has them grouped into three sets:

- How to do aquatic activities (skills, rules, safety, etc., primarily for recreation)
- Why it works (ARE based on knowledge of resources and basics of systems/processes at work)
- How to keep it coming (stewardship for sustainability).

There are opportunities in formal EE to address many aspects of ARE, but not all of them are appropriate for this medium. In this manuscript I will describe school situations amenable to ARE and describe research that can support working within classroom systems in appropriate and effective ways.

Does it fit?

The title of this manuscript was at first, "Does boating, fishing and stewardship fit the classroom curriculum." The answer to that question would have to be "No, but..." The "No" part helps to explain why the question had to be changed: if the job is defined so narrowly, the classroom is the wrong place for it to be done. First, the traditional classroom curriculum, still followed in over 90% of schools despite national calls for reform in key subject areas, requires teachers to be accountable for a given body of prescribed information in a finite time period. That information is usually presented from a textbook, to pupils seated indoors, and assessed by competitive testing systems. Being on the test determines the relevance of the subject matter. Second, teachers have been prepared either in a specific discipline that defines their comfort zone for in-

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struction, or in the case of elementary teachers, in the range of subjects that young students must learn. Both the depth of secondary school disciplines and the urgency of the elementary curriculum are effective deterrents to inclusion of boating, fishing, and stewardship in schools. The "how-to" subject matter of boating and fishing just does not fit in any but the rare Physical Education programs of recreation education.

Stewardship education creates other issues for schools because it represents a value system. In some periods of school curriculum history, a humanistic approach has been acceptable and could include values clarification. In today's society, vocal parents or community groups may openly oppose school programs that appear to teach children what to believe (for example, the Center for Environmental Education Research, a project of the Competitive Enterprise Institute, provides anti-EE information for parents). Notwithstanding that the school programs make concerted attempts to portray their stewardship programs as community education, conservative groups can gather media attention to their protests and effectively stifle well-meaning efforts. A teacher in my city was threatened with a lawsuit because he invited students to help collect waste oil products on a weekend for recycling. Though participation was voluntary, this was seen as imposing his environmental values on the students.

Finally, to have boating and fishing how-to instruction would require some hands-on outdoor experience, but many schools are unable to take field trips and most do not have facilities nearby for such instruction. Field trips are stifled by rules against taking school buses beyond county lines in some districts, and by prohibition on private drivers in others. This assumes, of course, that there are qualified instructors, and that other teachers are willing to excuse students from classes they would miss during a field experience that might appear to be primarily recreation instead of school. Under the set of conditions outlined here, then, "No" is a defensible answer for many educators.

Does the chapter end here?

The rest of the answer to that original question (No, but...) is the one that would allow the possibility for inclusion of some aspects of ARE in schools. Curriculum restructure in science, geography, mathematics and other subject areas has broadened the scope of what can be sanctioned as school subject matter in those disciplines (still no how-to). Specific examples from national standards for these subjects offer some of the opportunities, based on "why it works" components of ARE.

Figure 1 – Science in personal and social perspectives

Levels K-4	Levels 5-8	Levels 9-12
Personal health	Personal health	Personal and community health
Characteristics and changes in populations	Populations, resources, and environments	Population growth
Types of resources	Natural hazards	Natural resources
Changes in environments	Risks and benefits	Environmental quality
Science and technology in local challenges	Science and technology in society	Natural and human-induced hazards
		Science and technology in local, national, and global challenges

Source: National Science Educations Standards 1996.

National Science Education Standards (NRC, 1996) were designed to make science relevant to students, thus some of the physics of sailing, the human impacts of water uses, trophic relationships of fish, and the biology and chemistry of water quality can easily be included in the content of instruction. Stewardship aspects still require caution, but can be approached through historic human impacts and data analysis for decision-making, through the Standards on Science in Personal and Social Perspectives. This set of standards includes the topics in Figure 1. Another science curriculum reform movement, represented by the *Benchmarks for Science Literacy* (AAAS, 1993), is used less than NSES because of an unwieldy format, but can still legitimize ARE in some areas of science instruction. Benchmark examples include:

- The amount of life any environment can support is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle the residue of dead organic materials. Human activities and technology can change the flow... [Flow of Matter and Energy, Grades 9-12.]
- Individual organisms with certain traits are more likely than others to survive and have offspring. Changes in environmental conditions can affect the survival of individual organisms and entire species. [Evolution of Life, Grades 5-8]

Framework of Understandings for Earth Systems Education

1. Earth is unique, a planet of rare beauty and great value.
2. Human activities, collective and individual, conscious and inadvertent, affect Earth systems.
3. The development of scientific thinking and technology increases our ability to understand and utilize Earth and space.
4. The Earth system is composed of the interacting subsystems of water, land, ice, air and life.
5. Earth is more than 4 billion years old, and its subsystems are continually evolving.
6. Earth is a small subsystem of a Solar system within the vast and ancient universe.
7. There are many people with careers and interests that involve study of Earth's origin, processes, and evolution.

A third curriculum restructure program for science is the grassroots, teacher-focused Earth Systems Education (Mayer and Fortner, 1995). ESE is a way of looking at the science curriculum with a focus on planet Earth, with its inherent wonders and local relevance to students. Based on a framework of seven Understandings, ESE describes the desirable outcomes of science education K-16 as identified by a group of leading teachers, science educators and scientists:

Clearly, stewardship (Understanding #2) has a high priority for science education about the Earth System. Indeed, in its higher education programs for Earth System *Science* Education the National Aeronautics and Space Administration (NASA) places great emphasis on use of its space missions to learn about global environmental issues on Earth (Earth System Science, 1986). ESE is now being adapted in many forms in over 20 countries as science educators come to see its inherent value for today's science and Earth's future. Water, as one of the basic Earth subsystems, is a primary subject area and the topic of many curriculum innovations within ESE. [Best practice in instructional methods will be discussed in a later section.]

Geography is another subject area in which national standards hold opportunities for ARE (Downs, 1994). Of 18 Standards, those related to Environment and Society (# 16-18) are most easily identifiable with ARE, but the Box above demonstrates how a workshop on Aquatic Nuisance Species would use some other standards in teacher education.

It is also possible to use aquatic resources in the teaching of other subject areas as well, but in all cases, the resource in its recreational context is not the curriculum subject, just the vehicle through which the subject is taught. Some examples could include distant-rate-time problems using boat races or approaching storms, matching artificial lures to natural insects, or choosing lures that mimic natural prey of the desired fish.

Components of Environmental Education

Dr. William Stapp was the first to concisely define environmental education (1969):

> "Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution."

Thus, if we are looking for "what works," we need to consult the EE literature for indicators of quality in promoting knowledge, changing attitudes, developing intention to act, and gaining action skills. A "best practice" will involve as many of the four components as possible and will be achievable within the structure of school education.

Knowledge Change

The best predictor of the knowledge outcome of any EE practice is prior knowledge. People who start a program with high knowledge have less to gain from it, but they may also have the strong cognitive scaffolding upon which to build new learning (constructivist viewpoint, as in Dewey, 1938; Driver, 1984). Therefore a first step in determining success of a practice is to assess where the participants began. We have numerous examples of ways to do this, and baseline numbers to indicate starting points. For example, 5th and 9th grade students can answer about 38% and 48%, respectively, of knowledge questions about interdisciplinary topics of the oceans and Great Lakes (Fortner and Mayer, 1991). Their teachers report knowing enough about key aquatic topics to teach them adequately, but many topics are not taught because they are not seen as a priority or do not have a perceived place in the curriculum (Beiswenger, et al, 1991; Fortner and Meyer, 2000; Fortner and Corney, in review). Beiswenger's article actually identified "recreation" as the 2nd highest topic for teachers' water knowledge in Wyoming, and it

ranked 4th as a teaching priority, with 50% of the respondents reporting it as either "high priority (frequently or always used in the curriculum)" or "use in curriculum varies with situation." Recreation was not included in the Fortner surveys of science teachers.

In various literature reports of specific projects, there are examples of students' knowledge being increased by (or related to) the following educational opportunities:

- In-service education of their teachers over an extended period (Fortner, Corney and Mayer, in review, Supovitz and Turner, 2000; Paul and Volk, 2000; MacGilchrist, 1996).
- Innovative infusion materials in locally relevant science (Fortner et al, in review).
- *Naturescope* magazines used in class (Armstrong and Impara, 1991).
- Specific emphasis on a topic in instruction (Birch and Schwab, 1983).
- Material certain to be tested.
- Watching an environmental documentary on television (Fortner and Lyon, 1985).
- Reading *National Geographic* and *National Wildlife* magazines (Fortner and Mayer, 1991).
- Pre-trip instruction about a natural site, by a visiting scientist (Lahm and Fortner 1986).
- Instruction in the field: resident and extended programs (Lisowski and Disinger, 1991; Jordan, et al, 1987; numerous dissertations 1970-85).

The knowledge of teachers about environment and about ways to teach it has been the subject of many reports. The most comprehensive ones in terms of geographic scope have dealt with how teachers use nationally disseminated infusion materials such as Project WILD and how teacher education mandates have worked in Wisconsin (Lane, et al, 1996). In the former study, nearly 90% of teachers reported using at least one WILD activity within a year of training. There is no indication that the teachers went beyond the materials used in their training workshop, either to learn more or to teach more about the environment. (Heimlich at Ohio State is conducting a new study of WILD impact in 2001.) In the Wisconsin study, authors followed up on elementary teachers who have been trained in environmental education since it was mandated by the state in 1985. After ten years, over half of the new teachers did not recall such training, and did not implement EE to a greater extent than teachers trained before 1985. They
reported that they did not feel effective at infusing EE but personally know more and have more positive attitudes (Lane, et al, 1996).

Teacher knowledge and the impact of teacher education on classroom practice have been the subject of science education research as the National Science Foundation seeks evaluation of its state systemic initiatives. The kinds of teacher education programs that impact classrooms are those that have certain characteristics. According to Supovitz and Turner's (2000) synthesis of the literature, high quality professional development must:

- Immerse participants in inquiry, questioning, and experimentation and therefore model inquiry forms of teaching.
- Be both intensive and sustained.
- Engage teachers in concrete teaching tasks and be based on teachers' experiences with students
- Focus on subject-matter knowledge and deepen teachers' content skills.
- Show teachers how to connect their work to specific standards for student performance.
- Be connected to other aspects of school change.

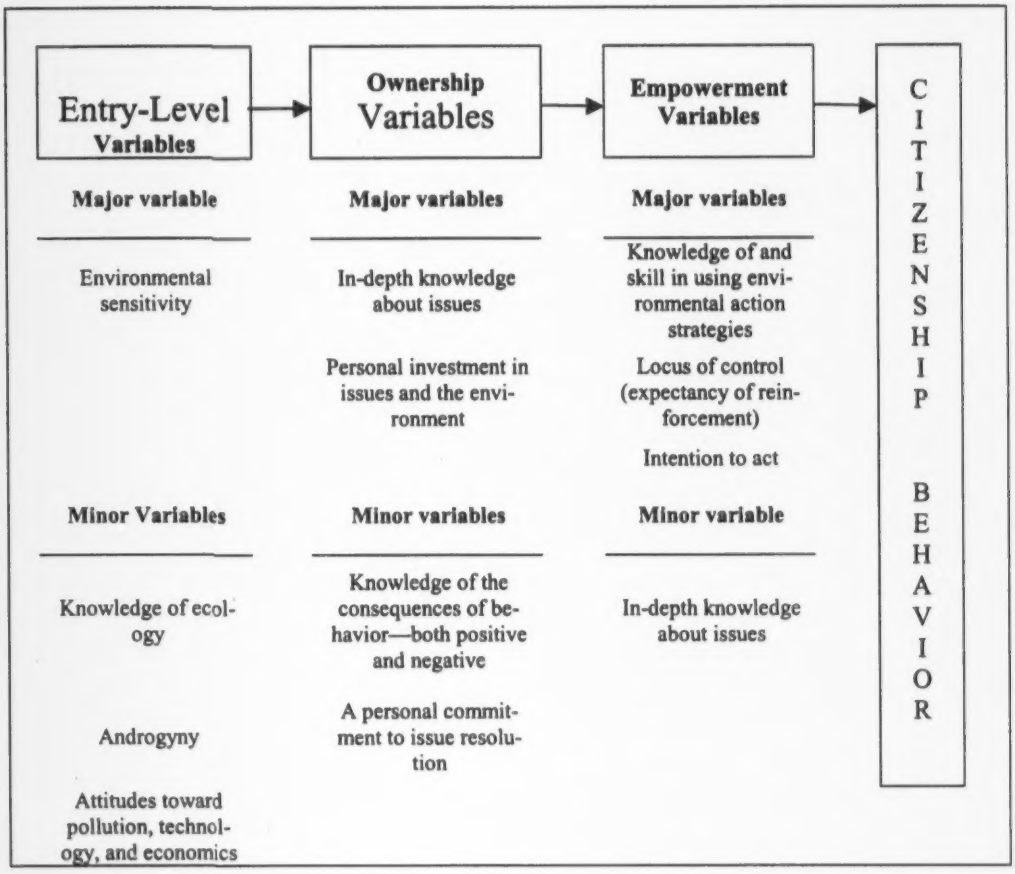
Such work is confirmed by programs in Ohio such as Kahle and Rogg (2000) and Fortner et al. (in review). All these works have emphasized that successful programs rely not only on teacher education but also on high quality curriculum materials.

Attitudes about the Environment

Newhouse (1990) defined environmental attitude as "an enduring positive or negative feeling about some person, object or issue." Attitudes are intimately associated with knowledge and often with behavior, but links among these attributes are inconsistent. We would like to think that teaching (providing information) about the environment or its issues would change people's attitudes about it so they would act on its behalf. In reality, the relationships are considerably more complex. Attitudes toward science and the environment are both generally positive among students, though most students report that even though these are important subject areas they are not very interested in them (Ma and Bateson, 1999).

The literature of EE reports that many kinds of experiences are capable of altering the attitudes people have about the environment. In one large study, a

Figure 2: Behavior flow chart: Major and minor variables involved in environmental citizenship behavior.

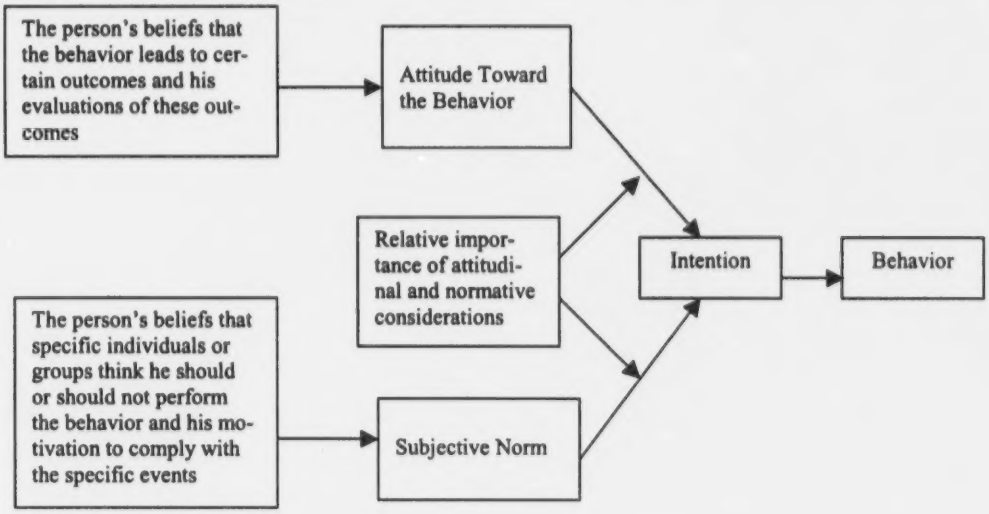


Source: Hungerford and Volk 1990.

multi-year program of teacher education about Issue Awareness and Investigation has been assessed by teacher follow-up (Paul and Volk 2000). The program has resulted in a high level of teacher use after extended training, and teachers report that there has been a positive response by parents and the communities in which the materials are used. Students in the teachers'classes register improved environmental attitudes. Other ex periences that are related to positive changes in environmental attitudes include:

- Viewing a television documentary (though changes are short-lived) (Fortner and Lyon 1985).
- Media exposure in general (films, television especially) (Murphy, 1996).
- General positive attitude toward science (Ma and Bateson, 1999).
- Visit to a unique area, including a "fun" factor, with attitudes persisting for more than one year (Ryan, 1991).
- Frequent exposure to natural environments as part of school, family and other experiences (Chawla, 1999).
- Some teacher education programs (Lane, et al, 1996; Paul and Volk, 2000).
- Resident outdoor education programs (Dettmen-Easley and Pease, 1999; Zelezny, 1999; numerous others in 1970s and '80s).

Figure 3: Theory of Reasoned Action.


The person's beliefs that the behavior leads to certain outcomes and his evaluations of these outcomes
Attitude Toward the Behavior
Relative importance of attitudinal and normative considerations
Intention
Behavior
The person's beliefs that specific individuals or groups think he should or should not perform the behavior and his motivation to comply with the specific events
Subjective Norm

Source: Ajzen and Fishbein 1980.

Behavioral Intention and Skills for Action

The ultimate goal of environmental education is behavior change, and the strongest predictor of that appears to be "intention to act." A model has been developing at Southern Illinois University for many years based on EE literature alone (Hungerford and Volk, 1990), and it is widely accepted in the field. Based on this model (Figure 2), one might pursue the precursors of behavior with some assurance that the desired behavior would follow. EE needs to look beyond itself, however, because as a young research enterprise it could gain much from use of existing and well-established models such as the Theory of Reasoned Action (TORA) (Figure 3). This model from psychology includes the influence of the community within which the behavior will occur, and the norms of that group may actually be the strongest force acting on the behavior, regardless of instruction or other treatment.

An excellent meta-analysis of studies has been published by Zelezny (1999) to compare the effectiveness of various formal and non-formal EE treatments for "improving environmental behaviors." She found that classroom treatments were more effective than non-formal treatments, and those that used active involvement and/or younger participants were most effective. Unfortunately, much of the research she examined had methodological flaws, and most of the behavioral outcomes were self-report. Nevertheless, this is the best study we have to date combining diverse literature reports. The treatments noted in the effective research included:

- Instruction
- Issue investigation and action training
- Resident camp
- Weekend activities

Other literature has indicated that the following facilitate the development of "environmentally responsible behavior:

- Internal locus of control of reinforcement (Hines, et al, 1986-7).
- Opportunities to practice behavioral skills (Ramsey, 1993).
- Teachers or classes (Chawla, 1999).

Best practices for EE in Schools

Strong Science

To fit the first two components of EE's definition into the school curriculum is relatively simple because knowledge and awareness of interactions of the natural world are acknowledged outcomes of a good science program.

It is critical that EE be based on sound science, relying on genuine data collected in rigorous ways and without foregone conclusions. Critics of EE look for ways to challenge the science used to support environmental causes (e.g. Sanera and Shaw, 1996), and data that have an aroma of advocacy are prime suspects. EE must use science datasets that are above reproach in their source, collection methods and interpretation. Given that science is falsifiable, those who use data for EE must be open to reconsideration and alternative interpretations of their conclusions. For instruction, data should be introduced as the vehicle for decision-making; students should be taught to select and evaluate science methods to find those that provide a range of data for decisions, and information about the weight of evidence should always be available.

An example of how this works with ARE is found in the activity "Downeaster Alexa," part of the Earth Systems Education ACES book (*Activities for the Changing Earth System*, 1993). The activity deals with declining stocks of striped bass in the commercial fishery of Long Island Sound, and data from the National Marine Fisheries Service are the basis of the investigation into why fewer fish are being caught. Other data include thermal niche of the fish, reproductive potential, size of fish at catch, and impact of fishery closure in one state. All data sources are documented from credible sources. Data analysis alone points to overfishing and taking of progressively smaller fish. Recovery of the fishery after a period of closure adds weight to the conclusion. If changes in sea temperatures (global warming) are a factor, the data in 1993 were inconclusive. It is actually likely that more striped bass would find the region habitable under all the GCM scenarios, resulting in a greater catch rather than the observed decline.

Curriculum Access

If the topic is not in the school curriculum, getting it there could be a losing battle. Teachers are under serious pressure to be accountable: to meet the scope and sequence of topics that are their formal responsibility. The teachers who get the students next year depend on this as background, and proficiency test contents may also drive that required list. It is not a question of how valuable the topic is perceived to be.

The curriculum doors may open if the new topic can be used to teach an old standard one. Biology students must learn about food chains, for instance, and if a food chain relates to a walleye caught in Lake Erie (Fortner and Leach, 1979, 1997) then that can be the entry for some form of fishing education. Educators call this process "infusion," substituting non-textbook material as the method or vehicle for teaching a topic that is required in the existing curriculum. Frequently this is local information, a blending of materials, or a nontraditional format for learning that is seen as desirable.

ARE is not unique in looking to curriculum infusion for its entrée to schools. In fact, most schools that include environmental education do so on an infusion basis rather than a course that treats EE as a separate subject. Environmental educators see the value in such an approach but also the hazards. Infusion depends on good quality materials and teachers well trained to use them. EE can get into any subject area this way, but teachers must be convinced one-on-one that their subject matter is not being eroded. Infusion success is very difficult to evaluate because it is diffuse and individualized, and it may disappear when additional curriculum pressures appear.

Interdisciplinary

EE is not "pure" science in terms of standard disciplines, so another best practice is interdisciplinary (Wade, 1996). To teach about the environment requires consideration of interactions of the atmosphere, hydrosphere, lithosphere and biosphere, with human activities included. New curriculum reforms allow for this, but teachers have difficulty instituting it because most were trained in specific standard disciplines. A good starting point for making science as interdisciplinary as it needs to be for EE is to have infusion of topics that cross disciplines.

The curriculum that could include much of the why and the stewardship for ARE would cross not only science disciplines but would blend them with social studies, math, perhaps even the arts and literature. (Think "Big Two-Hearted River," "A River Runs Through It," and "Paddle to the Sea.") The Downeaster Alexa activity previously described is based on a Billy Joel song by that name, in which he describes the declining fishery in terms of its impact on the life of a bayman. From the song we learn about the alternative species, depth of fishing required, distances offshore for successful catch, the heritage of fishing, and the impact of the lost income on the fisher's family.

Active, Cooperative Learning

"Hands-on" has been an expectation of high quality education for decades, and the current term in use reaches further to "Hands-on, minds-on." The change stresses that activity for activity's sake is not the goal, but use of active learning for engaging the mind on a task is the desired outcome. To look at a classroom doing good EE would bring an image of students in small groups talking seriously with each other as they conduct their investigations. They have data, implements, maps,

web sites and plans for answering an important question. They are using more than one scientific method--the controlled experiment has limited use in EE but more often the investigation is based on historical or observational data. The shift is from things that happen "here in the lab, right now" to "out in the world over a long time." They are examining the factors that inhibit salmon (or butterfly) migration, modeling insects (tying flies?) that survive or are eaten by predators, simulating the impact of a dam on wildlife in and around a river. While one group does a lab component, another constructs a questionnaire to ask parents about an issue, and a third group is gathering updated information from key web sites. When they pool their information, they have a greater chance at making informed decisions in answer to questions.

The cooperative/collaborative learning is an important aspect to best practice as well. For far too long we have been rearing students as competitors for grades. Instead many educators are shifting to the mode of cooperation toward learning goals for at least a portion of their class time. It is critical to show students by example that interdependence is the way the world really works: between people, between the environment and people, and within the natural environment. If no other attitude shift occurs in EE but this one, we will have been successful.

Extending Classroom Learning Beyond the School

"Service learning" gained attention in the late 1990s as a legitimate component of classroom education. This is a humanistic concept that comes and goes in the curriculum, so the realistic viewpoint is that its presence at a given time may relate to community or national politics. Obviously this is the kind of school activity that could greatly enhance the behavioral commitment goal for EE and the stewardship aspects of ARE. The first step is to develop decision-making skills to assist in the decision about what should be done, and what are the direct and indirect consequences of each action (including no action). If students have a chance to practice the skills that can lead to environmental quality or protection, they gain confidence in using those skills for other instances. The most effective service learning projects for schools are those that share information with the community: storm drain stenciling, flyers about control of exotic species, posters for storefronts about how to recognize harmful situations, etc. The school is a place for learning, and when the school reaches out, others should learn too.

Field studies are another obvious component of EE. While they are not as available in schools as in non-formal settings, a determined teacher will attempt to get students into the environment for studies. School groups that use their own outdoor areas or that visit field facilities such as Ohio State's Stone Laboratory on Lake Erie, or community parks and zoos, report a gain in learning. (But the reader should recall that Zelezny found many inadequate research methods in these reports.) The "novel environment" effect (hype over a day "out of school") can be avoided if out-of-class activities occur often and spontaneously, if specific tasks are pre-assigned to be done in the field, or if the experience is designed to feed back into ongoing school programs.

Assessing Outcomes of EE in Schools

Assessment should be based on objectives, and must take into account what people already know and do. Thus two types of assessment should be considered: Should we do it, and (assuming we do it) did it work?

The first and most commonly overlooked step, is the needs assessment or baseline study to determine whether the new program is needed, what parts are already mastered, how acceptable the plan or model is, and what barriers to implementation exist. If the school is the place where the ARE/EE will happen, teachers must be queried about the plan. In the Earth Systems Education program we typically follow the Rakow (1983) model and modify the topics. We ask teachers, for each topic:

- How important is it that your students know about this?
- How much do *you* know about it?
- To what extent do you teach about the topic?

From those responses, we have the teachers identify which topics they WANT to know more about (no use to spend funds on in-service programs with no participants!), and why they are NOT teaching some topics (identifies topics that just don't fit the curriculum, and also points out need for materials in some cases) (Fortner and Corney, in review).

Why not assess STUDENT knowledge and needs? The literature of EE, especially in aquatic education, has enough information to demonstrate low levels of student information without attempting major studies to justify ARE (e.g. Brody, 1996). An interesting note is that children often combine all kinds of environmental issues in their cognitive structure, so that one "evil" causes many destructions, or one good behavior (typically recycling) can solve all problems (Gowda, et al, 1997). If a specific topic is intended for students, a brief pretest may illuminate misconceptions and lack of key information.

Figure 4: Sample rubric developed by an Earth Systems teacher for use in evaluating individual student research projects.

Research Time Utilization	The student needed continual reminders to get back to work. Work may be inappropriate to the project.	The student was usually on task, but needed an occasional reminder to get back to work. All work is appropriate.	The student was always on task and did not need reminders to get back to work.
Participation in Project	The student does not add an equitable amount of work to the project and does not meet all requirements for the length of presentation.	The student adds an equitable amount of work to the project, but may not meet all requirements for the length of the presentation.	The student adds an equitable amount of work to the project and meets all requirements for the length of the project.
Accuracy of Information During Presentation	The student's information was lacking in content and was not factually correct in many places. Information may not be pertinent to the presentation.	The student's information is for the most part factually correct. Information may not be pertinent to the presentation.	The student's information is factually correct and pertinent to the presentation.
Clarity of Presentation	The student's work is not well planned. The student was confused by much of the information presented. The student was not clear in explaining topics.	The student's work is well planned. There seemed to be some confusion or misinterpretation of information.	The student's work is well planned and clearly explained. The student showed a clear command of the information presented.
Visual Aid Worksheet, or Simple Demonstration	The device used by the student was not used at a timely place in the presentation, had little bearing on the presentation, or was absent from the presentation.	The device used by the student was appropriate for the presentation. It may have been used in a more appropriate manner. The design of the device may not have maximized learning.	The use of the device was timely and appropriate. The design of the device was constructed to maximize learning.

Source: Mayer and Fortner 1995.

Outcomes Assessment

The evaluation technique should be in the same format as the treatment, so giving a multiple choice after a cooperative learning exercise is inappropriate. In fact, the most appropriate techniques for evaluation of EE are the ones considered "alternatives" to testing. We use rubrics if we are disposed to assign numbers to levels of attainment (Figure 4), and these are based on clear goals in various aspects of the learning. Typically the numbers indicate the relative value placed on different tasks within a project. For example, if data use is the main purpose of an investigation, data points might equal 30 of 50, while communication/interpretation skills rate 10 and group interaction 10. A new rubric should be constructed for each project type. Simpler rubrics list only the total points per component, while others break down intermediate steps toward excellence.

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Portfolios and journals are valuable grading tools that give insight into student growth in thinking and skill development. Journals can be based on the student's ongoing work that leads to a project (a researcher's professional diary of sorts), or on her/his thinking and pursuit of information about a subject area. A journal is a work in progress. In rare cases a journal is more personal, with reflections on nature or critical thinking about a class process. This type of journal may be reviewed but not graded; suggestions from the teacher are acceptable. Portfolios are collections of student work, with pieces typically "finished" when they were added but leading toward an increased proficiency (e.g., writings and revisions). A portfolio should be able to demonstrate to parents what kinds/qualities of student work are valued. In the cases of journals and portfolios, attention to the contents and quality of work demonstrated are the basis for evaluation

Projects are the most common forms of outcome for cooperative learning, and the communication skills for the projects are valued along with the science. The format may vary widely – a display, a videotape simulating a news broadcast, a group presentation with Powerpoint, a lesson for a younger group of students, or other medium prescribed by the teacher or selected by the students. Projects encourage cooperation, working toward a goal, and the importance of clarity of results. Students may be required to defend the information they are presenting as well. Projects are best evaluated with a rubric.

Some educators are concerned that since grades have to be assigned, and evaluation is so flexible, *all* students may be able to excel on the kinds of assessments listed. Environmental educators would respond that such an outcome would be wonderful! If EE is a community of scholars, acceptance of the work of others is appropriate, provided it meets community standards.

The question that was really answered: How can aquatic resource education succeed in the classroom?

According to theory and practice, environmental education topics that are appropriate to the curriculum can be infused if they are acceptable to teachers. The best EE is interdisciplinary, uses strong science, is implemented using active, cooperative learning, and is extended through service learning or field activities. Getting ARE into schools through EE can be accomplished by meeting teachers' needs for topics, having excellent curriculum materials, and delivering them through a strong program of teacher education. A model for this process from the Ohio Sea Grant Education Program is in Mayer and Fortner (1993): "A model for research and development interaction."

Recommendations for Research

There is a very large body of EE literature on the relationships between knowledge, attitudes and behavior toward the environment, but unfortunately much of the early years (through the '80s) were navel-study with bases only in other EE studies. In general our field could be enhanced and propelled forward by inclusion of the literature from older and more philosophy/psychology-grounded fields. In addition to that general upgrade in future research, some of the needs for this study are:

1) Methods for relating actual behavior to self-report (predictors of accurate reporting).
2) Follow-up studies for several years after participation in service learning.
3) Thorough scope of ARE, compared to matching points in existing school curricula.
4) Replication of Chawla (1999) using avid fishers/boaters as subjects (rather than activists).

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Guidelines For Best Practices In Aquatic, Fisheries, and Environmental Education

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Abstract –This paper gives some "guidelines for best practice" based on a literature review of environmental (including aquatic and fisheries) education and my own perspectives. Some highlights include: (1) We must be careful to define communication, education, outreach, etc. and the goals that we would like to achieve through these types of interventions to avoid misunderstandings and increase likelihood of success. For example, many believe education refers solely to information transfer and that information transfer is sufficient for behavior change when this is not necessarily so (e.g. environmental educators and others have shown that behavior change depends not only on changes in knowledge but also changes in skills, attitudes, and other factors). (2) Although much is known about promoting change in knowledge, skills, attitudes, and behavior, this knowledge has not necessarily been applied. This is evident, for example, by the results of evaluations of environmental education materials and programs that find many lacking in terms of pedagogy and content. (3) Many materials and programs exist but educators are not necessarily aware of them or have the necessary pre- and in-service professional development to use these resources appropriately. To the best of my knowledge the above observations are also true also for fisheries education although relatively little is known about fisheries education. For example, there has only been one survey of state aquatic education programs (from the perspective of aquatic education coordinators) which is now dated (published in 1994). In addition, there has been only one expert review (which needs to be updated) and only a limited number of outcome evaluations of fisheries education efforts. These evaluations suggest that behavior change is possible through fisheries education but that many fisheries education efforts are probably unlikely to achieve such changes. Future evaluations should build on past evaluations and in addition to behavior change, determine to what extent these efforts accomplish other environmental education and general education standards and goals.

Introduction

The following "best practice" guidelines are based on my experience with environmental education as well as aquatic and particularly, fisheries education. Because my background and experiences are mostly with formal environmental education and psychology, my perspectives are generally limited to those areas. There are likely to be relevant lessons from non-formal education, informal (including mass media) education, environmental communication (Guillierie and Schoenfeld 1979), and environmental interpretation (Knapp 1998) and in the literature outside the U.S. that I have not captured.

Definitions

There is a need to define environmental education (EE) and come to agreement on definition and goals to facilitate communication. I believe that many think of "education" and "communication" (or information transfer or outreach) as the same thing when they are different. In addition, many still believe in the information—knowledge–behavior model. Those who have followed this model know that it is challenging to transfer information in ways that will increase individuals' knowledge and that knowledge may be necessary, but is unlikely sufficient, for behavior change. Thus, providing individuals solely with information will not necessarily lead to individuals who are able and empowered to improve their own decisions or to participate in public decisions. Educators have a much broader view of education that focuses on the cognitive and affective development of individuals. Thus, educators view the transfer of information or communication as contributing to education but they do not assume that communication results in education (Guillierie and Schoenfeld, 1979). This view is also consistent with dictionary definitions (Random House Dictionary of the English Language, 1987) of "communication" as *the imparting or interchange of thoughts, opinions, or information by speech, writing, or signs;* and "education" as *the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life.*

Disinger (1983, 1998) provides an overview of the origins of environmental education (i.e., nature study, conservation education) and subsequent definitions of

EE. The citation typically used, however, in support of the definition of EE is UNESCO (1987). UNESCO (1987) actually focuses, however, on what it calls "objectives" (goals would be more appropriate) for EE; that is, awareness, knowledge, attitudes, skills, and participation. The following EPA definition is also cited at times, "environmental education enhances critical thinking, problem solving, and effective decision-making skills and enables individuals to weigh various sides of an environmental issue to make informed and responsible decisions (Federal Register, 1996).

Definitions of aquatic/marine education can be derived from Goodwin and Schaadt (1978), Lemon et al. (1987), Fortner (1991) and of fisheries education from Zint and Dann (1995). These definitions are consistent with definitions/goals of EE but are set in a narrower context.

It is the "participation" goal that has and continues to provide a problem for environmental education. Because individuals engaged in environmental education are typically environmentalists, they tend to be advocates of specific behaviors more so than educators. Instead of advocating for specific behaviors, it is argued that environmental educators should focus on providing individuals with the knowledge and skills they need to engage in action (Hug 1977, Disinger 1998). Methods for how environmental educators can prepare individuals for environmental participation are summarized and reviewed by Bardwell et al. (1994).

Generally, EE has focused on promoting knowledge of the environment, environmental ethics/affect, and skills needed to engage in environmental behaviors. Instead, some argue that environmental education should improve students' literacy and the quality of education in general (Robottom 1987, Lieberman 1995, Simmons 1995, Wade 1996, NAAEE 1997). This is in part because EE is believed to improve teaching and student learning (Billings et al. 1996, Lieberman & Hoody 1998, Wiley, 1999, NEETF 2000). Thus, what is being called for is a different approach; one that focuses on the "education" as opposed to the "environment" part of environmental education. I believe we need to recognize both aspects of environmental education.

Behavior Theories and Models

Because the ultimate goal of environmental education has been "participation" or "action" or "behavior" (UNESCO 1987), environmental educators seek ways to promote durable (long-term, self-maintaining) behaviors that also generalize to other behaviors. Environmental educators have recognized that the determinants of behavior are multiple (i.e., the Information – Knowledge -- Action model is insufficient) and have looked toward the more comprehensive model proposed by Hungerford and Volk (1990) [based in part on Hines et al. (1986/1987)]. The authors of the model and their colleagues believe they have empirical evidence to support this model. For example, see Volk and McBeth (1998) for a summary and review of relevant studies. Because the proposed measures of the constructs in the model may not be reliable or valid (Covitt and Zint In Review) and for other methodological reasons (e.g. use of past behavior as dependent variable), however, I believe that there is little evidence to support the Hungerford and Volk behavior model and that environmental educators should also consider other behavior theories/models. For example, Zint (in review) conducted some work on the theory of reasoned action and planned behavior with teachers that may be informative. There is also interesting work related to motives (i.e., material incentives/disincentives, altruistic reasons but particularly, intrinsic motivation such as competence) (e.g. see DeYoung 2000 for review and background). In general, I think we can learn much from health educators who have much experience with behavior change (see Glanz et al. 1997 for applied review of relevant theories and models). An interesting model pertaining to environmental risk education (Zint In Press) is provided by Gardner and Stern (1996) in Chapter 9 of their book. Lastly, much research on changing behavior takes a cognitive approach and we should not neglect affective approaches. Matthews and Riley (1995) have summarized perspectives on affective environmental education but again, I believe we would benefit from looking at work in other fields such as psychology (e.g., see Bagozzi et al. 1999 for definitions and overview).

Materials and Programs

I strongly believe that we do not necessarily need more materials and programs but that we need ways to easily find existing materials and programs and learn to what extent these resources are quality materials and programs with regard to both content and pedagogy. Development of new materials and programs should only occur if evaluations have identified gaps and if development builds on existing efforts.

Searches of databases (e.g., ERIC, Eisenhower Clearinghouse) and the web (e.g., EE-Link, GLIN, BRIDGE) reveal a wealth of environmental (including aquatic and fisheries) education materials and programs. There are few single sources, however, that provide comprehensive listings of materials and programs, and those looking for them may not know these sources. Moreover, many listings provide limited information about materials and programs.

There have been some efforts to identify relevant materials/programs on specific topics such as aquatic education (Gigar 1990/91), biodiversity (World Wildlife Fund 1998), environmental education (NAAEE 1997, 1998a, 1998b), fisheries (Crook and Zint 1998), Great Lakes education (Great Lakes Environmental Education Center, forthcoming), marine education (Broussard and Skupien 1994), and water (Andrews 1995). These materials should be updated and improved upon. For example, our listing of fisheries education resources (Crook and Zint 1998) is probably in need of revisions.

Dissemination of Materials and Training

If we want educators to use materials, we must train them in using the materials. Mayer and Fortner (1987) found that simply mailing and/or disseminating materials for free will not result in use and that shorter workshops are more effective than longer (for credit) workshops. Educators who have received this type of training, however, are only likely to use the specific activities that they received training in, as opposed to other activities in the material (Pitman 1996).

Professional Development

In-service and pre-service environmental education preparation of teachers is limited (Lane et al. 1995). If barriers to environmental education are to be overcome (Ham and Sewing 1987/1988, Ham et al. 1987/1988) and to obtain fundamental change in how teachers teach about the environment (i.e., other than the activity mentality), we need more comprehensive professional development.

In-Service

Environmental education professional development is typically delivered by non-formal environmental educators in the form of short (about 2 day) workshops centered on activity guides such as Project Learning Tree and Project WILD or environmental topics such as water, wetlands, or wildlife (Lieberman 1995, Wade 1996). Such efforts are insufficient, particularly in light of current pressures to improve teaching and learning. There is a need for professional development programs that focus on education content, processes and/or pedagogy in addition to environmental content (Wiley et al. 1999, Wade et al., in review). We are currently conducting a study to learn about such innovative environmental education professional development programs (Giles and Zint, forthcoming). General education resources for how to improve teacher professional development include Birman et al. (2000), Loucks-Horsley et al. (1998), and Loucks-Horsley and Matsumoto (1999).

Pre-Service

Teachers who were exposed to environmental education during their pre-service are more like to integrate environmental education in their classrooms (Lane et al. 1995). Unfortunately, teachers are typically not required to take courses in environmental education (Ruskey et al., in review). Moreover, few faculty teach environmental education courses (Zint and Giles 2000). I believe, however, that these faculties represent an important resource and more attempts should be made to collaborate with them.

Professional development for other educators

There is also a need for the professional development of educators other than teachers. Many non-formal environmental educators, for example, have no formal training in environmental education and/or in pedagogy in general (Wade, 1996). It is important that they, for example, learn how to promote behavior in ways that enhances the education of individuals. Again, this professional development should be provided in pre-service (e.g. human dimensions courses) and in-service contexts.

Standards

There are standards that we can and should follow. Concerns over environmental advocacy (e.g., Poore, 1993, National Environmental Education Advancement Project 1996, Schmidt 1996) as well as the movement to reform education (Simmons 1998) have led to the development of guidelines for environmental education. These include guidelines for materials (NAAEE 1996) and professional development (NAAEE 2000) as well as environmental literacy standards (NAAEE 1999). In addition to environmental education guidelines, we have a large number of national, state, district and school standards that we should help to meet if we are to be environmental educators. If new materials/programs are to be developed they should take into account these standards -- regardless of educational setting (i.e., formal, non-formal, informal).

Evaluation

If evaluations of environmental education programs are conducted [including of angling education programs (Burroughs and Reeff 1996, Thomas and White 1995, Rupert and Dann 1998, Thieme and DiCamillo 1994), they typically have consisted of counting the number of participants and they sometimes consider program costs. More informative "outcome" evaluations of environmental education materials and program are rare but are

becoming more common in light of the need to defend environmental education from its critics (Samuel 1993).

Examples of expert reviews of environmental education materials include those by Simmons (1989), Pomerantz (1991), Boerschig and DeYoung (1993), Andrews (1995), Independent Commission on Environmental Education (1997), NAAEE (1997a, 1998a, 1998b), Crook and Zint (1998), and the Environmental Education Literacy Council (1999). These expert evaluations review the content and/or pedagogy approach of materials and programs. Future evaluations should build and improve upon these (e.g. use of greater number of reviewers). Content evaluations should be conducted based on agreed upon goals similar to the process used by Brody (1993) for water education and Crook and Zint (1998) for fisheries education. Pedagogical assessments should be conducted based on NAAEE (1996) guidelines and other relevant general education standards and guidelines.

Some of the findings from our evaluation of fisheries education materials may be pertinent to state here (Crook and Zint 1998). For example, we concluded that coverage of biodiversity and of some concepts associated with building sustainable fisheries and promoting stewardship was limited. Broader aquatic resource education programs also seem to lack an emphasis on anglers as stewards (Thieme and DiCamillo 1994). We also concluded that materials that target students in K-3 and 9-12 levels, focus on global or marine fisheries, and provide multicultural perspectives are needed. It would be good to update and improve upon this fisheries education evaluation and a similar effort is needed for aquatic education materials and programs. Such evaluations provide information about existing resources that hopefully reduces the chance of duplication of efforts.

There are also examples of outcome evaluations of environmental education efforts. For example, there is a review of various Project WILD materials and program outcome evaluations (Pitman 1996) and a review of a number of environmental education outcome evaluations by Leeming et al. (1993) that should be informative. Because many aquatic education programs offer vessel-based education programs, an evaluation of such a program by Williamson and Dann (1999) should also be of interest. Similarly, our outcome evaluation of the Chesapeake Bay Foundation's environmental education programs (Zint et al. in review) might be helpful. There is also work to show how using the environment as an integrating context can improve general education outcomes (Lieberman and Hoody 1998, NEETF 2000).

Lastly, I have also come across a few fishing outreach program outcome evaluations. For example, Rupert and Dann (1998) evaluated a fishing program targeted at novice anglers (including children). The authors were able to design a program that increased participant intention to fish, purchase a fishing license and fishing equipment and met other goals. Rupert and Dann (1998) also cite fishing outreach program evaluations by O'Malley and Crawford (1995), Reynolds (1996), and Thomas and White (1995). A series of publications prepared in response to conducting an evaluation of the Hooked on Fishing Not Drugs programs are also available including Siemer and Knuth (1998) and Siemer et al. (1998). Finally, there is an exploratory study by Adams and Higginbotham (1999) of the Texas Parks and Wildlife Departments' outreach (including angler) programs. Because of a number of methodological reasons it is difficult to reach conclusions in terms of the results of the evaluation by Adams and Higginbotham (1999). The authors identify issues that arose during their evaluation, however, that might be helpful to future evaluators. These types of evaluations can tell us what existing efforts are worthy of supporting and can help us improve our efforts.

Audiences

In general little is known about how to best meet the environmental and aquatic education needs of multicultural audiences, including in fisheries education contexts (Zint and Crook 1998). Rupert and Dann (1998) cite a study by Burroughs and Reeff (1996) that might be of interest in this context.

Careers

Interest in the pursuit of environmental careers is evident by increasing enrollments in environmental science/studies programs (Romero et al. 2000). We recently conducted a study to identify information to help interested individuals learn about environmental careers (Zint and Hanson, In Review) and we also found that few environmental educators are aware of these resources (Hanson 2000). There may be a need for resources to help individuals learn about aquatic resources, including fisheries careers (Zint and Crook 1998), and to inform educators of these resources.

Status of Environmental Education and Needs

There is a great need for environmental education in the United States:

- Few teachers teach about the environment and/or use appropriate environmental education practices (Samuel 1993, Holtz 1996, Kirk et al. 1997, Smith-Sebasto and Smith 1997).

- Environmental literacy assessments of the U.S. public suggest that environmental concern is high but that environmental knowledge is poor (see www.neetf.org and review annual studies conducted by Roper). One of the most recent of NEETF's (2000b) national surveys included a question particularly relevant to this review: "The current worldwide reduction in the number of ocean fish is PRIMARILY due to which of the following (% of respondents who selected): a) pollution in coastal waters worldwide (40%), b) increased harvesting by fishing vessels (25%), c) changes in ocean temperature, or (12%), d) loss of fishing shoals and other deep sea habitats (6%), e) don't know (16%).

- Several reports provide additional expert opinions on the status of EE and importantly, recommendations for improving EE (Ruskey and Wilke 1994,

  National EE Advisory Council 1996, forthcoming, NAAEE 1997b). Recommendations that are made and that I also strongly agree with include the need for partnerships to work more inclusively and for research (particularly evaluations and on role of partnerships) to improve environmental education practice.

- Specifically with regard to outreach efforts to teach individuals how to fish and/or to provide fishing opportunities, I believe there is a need to conduct similar work as with hunter education programs (see Duda et al. 1995, Wildlife Management Institute and International Association of Fish and Wildlife Agencies 1996, Hunter Education Standards Task Force 1999). There is one study that asked each state about their aquatic resources education program (i.e., description of program, number of individuals reached, budget, use of partners, special features, etc.) but this study did not analyze information across programs and is now dated (Thieme and DiCamillo 1994).

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Best Practices in Boater Safety Education

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Abstract – This paper describes boater safety education programs in the United States. Boater safety education differs from other forms of environmental education considered in this document in its emphasis on safety as opposed to environmental stewardship. Environmental issues are often included in boater education programs, but receive much less emphasis than other topics related to safe boat operation. Recreational boating education in the United States is offered through a system of government agencies and non-government organizations, including the boating industry. The "best practices" in boater safety education include means of ensuring the *availability* of educational programs, ensuring the *content* and *quality* of the educational programs, getting more people to *obtain* the education, and finally, getting people to *act on what they learn.* The best practices include development of educational programs that are age- appropriate and suitable for boaters of all skill levels (including instructors), compliance with official boating education standards, and provision of boating courses through a variety of means (including traditional classes, self study and on-line courses). Commonly used specific practices include videos, practice examinations, provision of materials and equipment (such as loaner lifejackets for kids), mascots, incentives, and special events. There is a trend towards mandatory boater education, as more states are enacting laws requiring education for certain groups of boaters. At present, the best practices in boater education are defined primarily in terms of consensus of professional judgment or frequency of use. More research is needed to document the relationships between education/knowledge, boater attitudes and behavior, and the effectiveness of various educational approaches.

Introduction

Alabama recorded 11 boating fatalities during the first six months of 1999, despite a comprehensive boating safety law and ongoing efforts to teach boating and water safety. Consistent with national accident statistics, most of the fatalities involved capsizing, falls overboard, and people not wearing their personal flotation devices. The situation was described by Small Craft Advisory magazine (volume 14 (5): p. 17) as a "textbook example of lawmakers being unable to legislate against foolishness."

Many boating accidents could have been avoided if boaters "had only followed the rules of the road" (Louisiana officer Robert Duthu, quoted in *Small Craft Advisory* 14 (5): 21). Boating safely requires knowing the rules and abiding by them. There are two basic approaches to reducing fatalities, injuries, and property damage related to water-based recreation: education and enforcement. The two are inter-related and usually under the jurisdiction of the same agencies. Education is fundamental and lays the foundation for safe boating behavior. Enforcement can serve two roles, first as a deterrent to unsafe and illegal boating behaviors and secondly as an opportunity for education through interaction between agency officers and the boating public.

This paper focuses on "Best Practices" in boater safety education. The best practices must address many issues, including (from easiest to most difficult): ensuring the *availability* of educational programs, ensuring the *content* of educational programs (through educational standards, etc.), ensuring the *quality* of education programs (through recruitment and training of instructors), getting more people to *obtain* the education (both forcibly through legislation and voluntarily through promotions, incentives, etc.), and finally, getting people to *act on what they learn* (e.g. getting them to actually wear their life jackets, which could prevent up to 80% of drownings). This latter objective requires understanding the relationships between education/knowledge, attitudes, and ultimately, boater behavior.

The Boating Education System

Recreational boating education in the United States is offered through a longstanding "partnership" between the federal government, state and local government agencies, and a vast collection of non-government organizations. At the federal level, the U.S. Coast Guard administers applicable federal law and a grants program enabling other agencies and organizations to pursue boating-related initiatives.

The Federal Boat Safety Act of 1971 was intended to promote greater uniformity, reciprocity and comity among the states and the federal government. The act defined the roles of the federal and state government relative to boater safety education. In 1982, the Coast Guard Roles and Missions Study conducted by the

Table 1. Goals of Pennsylvania's Recreational Boating Safety Program

1. Reduce complaints about, and improper operation by, personal watercraft operators by increasing the number of operators receiving boating safety information in courses.
2. Certify 30,000 students to partially implement the requirements of the new personal watercraft regulation.
3. Certify 100 new boating safety instructors to teach boating courses and administer the new Boating Safety Education Certificate Examination Program (PWC Equivalency Exam).
4. Monitor the mandatory education issue for other powerboats while promoting the voluntary Pennsylvania Basic Boating Course.
5. Maintain the Volunteer Incentive Program (VIP) to prevent instructor burnout and encourage volunteer instructors to continue to teach. This program provides small gifts such as personal PFDs, ball caps, instructor shirts and "Trout Stamp" prints as an incentive to continue to participate in the program.
6. Continue to promote the Boating and Water Safety Awareness Program to schools. Incorporate the program into existing school curriculums by providing schools with the lesson plan in a modular format. Certify 2,000 students.
7. Develop a home study guide so interested boaters can better understand the importance of boating safety concepts. Give them the opportunity to test their boating knowledge.
8. Continue to offer the Water Rescue Training Program to train water rescue volunteers and professionals in proper rescue techniques.
9. Continue to foster a close working relationship with the U.S. Coast Guard Auxiliary and the U.S. Power Squadron's education programs for boater safety certification. Make certain that all Auxiliary Flotillas and U.S. Power Squadrons in Pennsylvania receive an update with certification instructions.
10. Continue to teach the Commission's Professional Boating and Water Safety Program to agency employees and other Pennsylvania state employees who work on, near, or in the water.
11. Promote safe boating habits and increase the knowledge of boaters through the production and distribution of boating safety literature through the mail, boat and sports shows, and other outlets. Continue to update the safety brochures, information sheets, and the Boating Handbook to ensure that boaters have up-to-date information on current boating laws and safety information. Provide a copy of the Boating Handbook to all first time boat owners, participants in Commission boating courses, and all owners of personal watercraft.
12. Maintain a video library available to boating safety instructors, various organizations, clubs, and individuals from across the Commonwealth.
13. Promote boating safety through news releases, radio advertisements, public service announcements, and radio and TV interviews.
14. Provide all liveries with instructions for implementing the new Commission regulation concerning mandatory boating safety education briefings to their customers.
15. Provide all personal watercraft dealers with instructions for implementing the new Commission regulation concerning issuance of temporary Boating Safety Education Certificates to their customers for completing the Commission's new Dealer Boating Education Program.
16. Continue the U.S. Coast Guard Auxiliary Grant Program to further promote boating safety through the support programs administered by the Auxiliary. The Commission has traditionally distributed up to $25,000 to the Auxiliary to support the expansion of their programs.

Source: http://sites.state.pa.us/PA_Exec/Fish_Boat/uscg99rp.htm

Office of Management and Budget concluded that the states should assume primary responsibility for recreational boating enforcement and education.

State Boating Education Programs

Boater safety education is offered in every state, although the agencies responsible for this function and methods of delivering the education vary considerably from state to state. Some states offer their own courses through their designated boating education agency, others accept courses offered by various organizations or cooperate with these organizations to deliver state-specific versions of a basic boating course, and others utilize a combination of approaches. Boating classes are but one part of the typical state boating education program. Table 1 demonstrates the breadth of activities within one state's (Pennsylvania) recreational boating safety program. It is notable that the goals of this program address many of the 'best practice" issues mentioned earlier and include some quantitative targets or standards.

Boating Organizations

There are many organizations that focus on boating safety. Some of the key organizations and the boating education courses that they offer are described below:

National Water Safety Congress

The National Water Safety Congress is a non-profit organization dedicated to promoting recreation water safety in the United States. The Congress was organized in 1951 in response to a growing number of recreation related drownings. The membership of the Congress includes water safety specialists from federal, state, and local governments, water/flood control authorities, water oriented utility companies, public safety agencies, water safety councils, and private individuals. The purpose of the National Water Safety Congress is:

- To eliminate or reduce the number of water-related recreational accidents, injuries, and fatalities in the United States.
- To instill water safety awareness in recreational users of our nation's waters.
- To develop a network of water safety professionals throughout the country.
- To establish or improve working relationships between federal, state, local agencies, organizations and individuals interested in water safety.
- To educate members and the public on current water safety initiatives and problems.

Annually, the National Water Safety Congress and the National Safe Boating Council host an International Summit. The goal of the International Boating and Water Safety Summit is twofold:

- To impact the safer use of on-the-water activities through public education and a more effective means of transferring information among boating specialists, education coordinators, waterway managers and user groups and individuals.
- To offer professional-level training workshops for federal, state, and local boating and water safety education and management personnel.

National Safe Boating Council

The National Safe Boating Council, Inc. (NSBC) was organized in September 1958 under the name, National Safe Boating Committee. The NSBC presently has a membership of over 290 U.S. and Canadian organizations with an interest in boating safety and education. Approximately 65% of NSBC membership is non-profit organizations and 35% is for-profit organizations. The mission of the NSBC is to reduce accidents and enhance the boating experience. The National Safe Boating Council accomplishes this mission by:

- Conducting a series of on-going National Campaigns to promote Safe Boating.
- Providing opportunities to work directly with national and international leaders in boating education.
- Improving the professional development of boating safety educators.
- Distributing safe boating information.
- Developing and recognizing outstanding boating safety programs.
- Supporting research initiatives that strengthen boating education and safety awareness.

National Association of State Boating Law Administrators

The goal of the National Association of State Boating Law Administrators (NASBLA) is to ensure safe and enjoyable boating for all who use the nation's waters. NASBLA's mission is to protect, promote and enhance safe and enjoyable boating and to foster partnerships and cooperation among recreational boating safety interests. NASBLA accomplishes this mission through a variety of initiatives, including advocating fair and equitable laws that provide uniformity and reciprocity among states in water safety and management, working for fair and wise use of federal funds for recreation boating safety programs, and establishing standards for boater safety education. NASBLA's Education Committee oversees the Minimum Standards for Boating Safety Education program. This includes reviewing and

Table 2. Summary of NASBLA Approved Non-State Boating Safety Courses

Organization	Name of Course	Valid Through
Alabama Traffic Safety Center University of Montevallo	Alabama Boating Basics -- A Guide to Responsible Boating	2003
American Marine Training Stratford, CT	Basic Boating & Safety	2000
American Power Boating Association	Boating Fundamentals	2002
American Sailing Association	Basic Keelboat Sailing	2003
Bayshore Books	Toward Safer Boating -- 48	2001
BOATCLASS.COM	Boater & PWC Safety Course	2003
BoatEd	Boat America: A Course on Responsible Boating	2003
BoatEd Inc. Dallas, Texas	Boat Georgia	2001
	Boat South Carolina	2002
Boating Ed & Charter Service, Beacon Falls, CT	Basic Boating Safety Certification	2000
Boating Safety Educators of America	Basic Boating Safety	2001
Boating Safety School of Florida	Boating Safety Course	2000
Boating Safety Institute of America	Boating Basics	2001
BoatUS	On-line Boating Safety Course	2002
Boatwise	Boating Basics and Safety	2001
Canadian Power & Sail Squadrons	Boating Course	2003
	The Boat Pro Course	2001
CEERI (Florida)	BoaterEd	2002
Chapman School of Seamanship, Stuart, FL	Evening Mini-Course (Florida)	2001
	Florida Boating Basics Course	2002
	PWC Basic Boating Course	2002
Chelsea Sailing, Inc.	Seamanship/Boating Basics	2000
City of Bridgeport Harbor Master's Office	Boating Basics: A Guide to Responsible Boating	2002
Coast Boating School	Safe Boating Course	2002
Coastal Yachting Academy	Practical Boating Safety, Seamanship & Navigation	2002

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Organization	Name of Course	Valid Through
Connecticut Boating Education	Safe Boating Course/PWC	2003
Connecticut Safe Boating, LLC	Basic Boating Safety	2002
	Basic Boating Safety & PWC Operation	2002
Corcoran, Raymond	Corky's Boating Basic Course/Connecticut	2001
Don Fleming Yacht Services	Don Fleming Yacht Services Basic Safe Boating Course - CT	2001
Empire Safety Council	Boating Safety Course	2002
Garden State Safety Council	Boating Safety Course	2001
Green Marine Services	Basic Safe Boating	2002
International Sail & Power Academy	Safe Boating CD-Rom	2003
Lighthouse Marine Service	Boat America: A Course on Responsible Boating for North Carolina	2003
	Boating Course for South Carolina	2003
Longshore Sailing School, Westport, Connecticut	Connecticut Boaters Guide	2001
Lytekeeper Marine Services	Basic Safe Boating/PWC Certification	2003
Mystic Safe Boating	Safe Boating Basics Course	2002
NASISS, Middletown, NJ	Recreational Boating Safety	2001
Nautical Know How Training Services	Nautical Know How Basic Boating	2002
New England Maritime	Maritime Boating Safety Course	2001
New England School of Boating	Connecticut Safe Boating	2002
Northeast Marine Services, Pawcatuck, CT	Safe Boating Course	2002
Rhode Island Maritime School	Toward Safer Boating	2002
Safe Boating Institute, Inc.	Safe Boating	2002
Safety Resources	Connecticut Basic Boating	2002
Safe-Sea Marine Services	Basic Seamanship & Boat Handling	2002
Sound Environment Associates	Learn from the Dolphins	2002
Toledo Community Boating Education Center	Basic Power Boating	2001
US Coast Guard Auxiliary	Boating Skills/Seamanship (11th)	2001
	Boating Safely (Mosby)	2000
	Skipper's Safe Boating Course (Mosby)	2000

Organization	Name of Course	Valid Through
US Sailing Association, Newport RI	Small Boat Sailing Instructor	2000
	Basic Keelboat Student Course	2000
University of North Carolina/Wilmington	Motorboat Handling	2000
US Power Squadrons	Squadrons Boating Course	2003
	For Sail & Power (video)	2002
	Boat Smart	2003
Vineyard Maritime	Safe Boating Course	2003
Watercraft Training Center (Canada)	Smart Rider/Operator Proficiency Course	2002
Westrec Yachting Center	Yacht Pro	2000

Source: http://www.nasbla.org/state_courses.htm

approving recreational boating safety courses. The Education Committee also participates in joint efforts with the National Safe Boating Council (NSBC) on National Safe Boating Week and the International Boating and Water Safety Summit. The committee is currently developing a Reference Guide to State Boating Education Laws and Regulations.

Non-State Courses

Boating organizations offer various types of courses and instruction in different formats, including classroom and field-based seminars, multi-lesson courses, self study, and on-line courses. As an inducement to participation, boating safety courses are usually free of charge (some may charge a small fee for materials, room rental, or postage and handling). A comprehensive listing of non-state courses approved by the National Association of State Boating Law Administrators (NASBLA) is provided in Table 2. Some of the courses offered by selected major boating-related organizations are described below to illustrate the educational opportunities.

The U.S. Coast Guard Auxiliary

The Coast Guard Auxiliary is one of the major providers of boating safety courses nationwide. In 1999, the Auxiliary reaffirmed the priority of its historic mission of providing boating safety programs to the public (McAdams, 1999). Seminar courses offered by the Auxiliary include:

- Boating Fun – Adventure on the Water – introducing basic safety concepts to children in grades K-3.
- Waypoints – A Guide to Boating Safely– for older children and youths in grades 4-6.
- Personal Watercraft – for those who want a brief, very basic introduction to the safety issues involved when operating a PWC.
- Navigating with GPS – for those who want a brief, very basic introduction to navigating with GPS.
- Boating Safely is a multi-lesson (eight-hour) course designed to appeal to hunters, anglers, personal watercraft operators and other boaters who cannot find time for a full, comprehensive course. Boating Safely was developed by the U. S. Coast Guard Auxiliary in cooperation with the US. Power Squadrons and Mosby Lifeline, and is approved by the National Association of State Boating Law Administrators (NASBLA). It is also approved by most of the states that require formal instruction in order to operate a boat. Course topics include: introduction to boating, boating laws, personal safety equipment, safe boat handling, navigation, boating problems, trailering, storing, and protecting your boat, hunting/fishing, water skiing, and river boating.
- Other multi-lesson courses offered by the Coast Guard Auxiliary include Boating Skills and Seamanship (for both beginning and experienced

power boaters), Sailing Fundamentals (also known as Sailing and Seamanship), Basic Coastal Navigation (an introduction to coastal piloting), and Advanced Coastal Navigation (for serious boaters who want to learn piloting techniques). The C.G. Auxiliary also offers the Skipper's Safe Boating Course, a self-paced, home-study course that provides a basic introduction to boating. United States Power Squadrons

The United States Power Squadrons (USPS) is a non profit, educational organization dedicated to making boating safer and more enjoyable by teaching classes in seamanship, navigation and related subjects. USPS has about 60,000 members organized into 450 squadrons across the country and in some US territories. This organization's name dates back to its founding in 1914 by the power boat division of the Boston Yacht Club. Currently, USPS lists itself as *America's Boating Club* for sail and power boating, and more than 40% of its members are sailors.

USPS makes a number of educational courses, both instructor led and self learning, available to the public as well as its members. The Squadron Boating Course and Boat Smart are instructor led courses given locally by individual squadrons. The USPS boating course is also available for home study on a video. Members can enroll in advanced courses on Seamanship, Piloting, Celestial Navigation, Weather, Sailing, Engine Maintenance, Marine Electronics and Cruise Planning. In addition, USPS offers more than two dozen self study courses on such subjects as Water Sports, Boat Insurance, Oceanography, Introduction to Sailing, and Preparation for Coast Guard Licensing.

An innovative feature on the USPS internet site is the link to a national safe boating test, designed to allow boaters to test their boating knowledge using a self-marking quiz. Made possible through a grant from the Aquatic Resources Trust Fund administered by the U.S. Coast Guard, this site includes a series of pictures illustrating various aspects of boating safety. The site also introduces the new interactive electronic America's Boating Course, co-produced by USPS and the U.S. Coast Guard Auxiliary. In addition to the website, the national safe boating test will be broadcast on prime time television three times during National Safe Boating week (May 19-26, 2001). Following the broadcast, USPS will distribute 10,000 videos to various boating-related organizations. USPS expects this program to have a major impact on boating safety by demonstrating to millions of boaters across America the need for all boaters to complete a boating safety education program.

Boat Education: http://www.boat-ed.com/

- Boat Ed is a private organization dedicated to providing boater safety courses and certification and publishing boater education materials. Boat Ed offers home study courses in cooperation with state government agencies responsible for boater safety education and certification. Boat Ed's state-specific courses are approved by the state government agency responsible for boating as well as NASBLA and are recognized by the U.S. Coast Guard. The Boat Ed website offers:Online boating safety courses with online boater certification tests for selected states (Alabama, Georgia, Indiana, Mississippi, Missouri, North Carolina, Ohio, Oregon, South Carolina, Texas).
- Home-study video boating education courses for these states.
- Information on classroom boat safety courses in these states.

BoatUS: http://www.boatus.com/

BoatUS, the Boat Owners Association of the United States, also provides online courses that are NASBLA approved and Coast Guard recognized. Topics covered in their courses include boating basics, communications, safe survival, safety equipment, the environment, navigation and navigation aids, small craft issues, rules of navigation (rules of the road), charting and piloting, regulations, boat handing, personal watercraft, and inland boating.

BoatClass.Com: http://www.boatclass.com/

BoatClass.com provides boating safety courses meeting NASBLA standards and boater certification requirements in various states. States that are currently served include New York, Connecticut, and Delaware. Certification is in progress for New Jersey, New Hampshire, Massachusetts, Rhode Island, and Pennsylvania. BoatClass.com offers the following courses:

- Boater & PWC Safety Courses. A one-day NASBLA approved, USCG recognized, eight-hour class to meet most state requirements for a boater/PWC safety certificate.
- Inland & Coastal Navigation. The course consists of 8 hours (3 sessions) of instruction aimed at sharpening navigation and piloting skills and building the confidence needed to venture to new places offshore. Includes charting, plotting, dead reckoning, GPS, fuel calculations, position fixes, cruise planning skills and more.

- Marine Weather. A plain-language, practical, 8-hour course for inland and ocean sailing. Emphasizes how to combine observations of wind, sea, clouds, and barometer to better interpret official forecasts obtained from radio or facsimile as well as make your own forecast if you lose the official sources. Also presents practical rules of thumb that can contribute to sound and efficient decision making underway.
- Marine Radar. A practical (8-hour) guide to safe, versatile, and efficient use of small craft radar, including radar principles and operation, definition of terms, navigation by range and bearing, use of VRM and EBL in navigation and collision avoidance, identifying radar targets and interpreting their motions, how to apply the Rules of the Road, and how to interpret land masses seen on radar. Claims to increase the safety and efficiency of your radar watch many fold and greatly reduce the anxiety of encounters with converging radar targets that cannot be seen visually.
- GPS Plus! Designed to take boating knowledge to a new level and keep boaters' investment "off the rocks" through GPS navigation. How does it work, why do I use it? Covers uses for GPS besides just where am I?, when will I get there, how fast do I need to go to be back for dinner?
- Rules of the Road. The course consists of 8 hours of instruction and is based on the *Wheelhouse Companion*, a resource designed for professionals and recreationalists alike. More than 85 million people now participate in recreational boating in North America. Many share 'navigable' waters with commercial and military vessels of all types. All must comply with the same Rules of the Road and understand these rules for proper and safe conduct on these shared waters. The course covers these rules in a multi-media environment. There is a recreational and professional option for this course.

Boatsafe: http://www.boatsafe.com/

Boatsafe.com offers online boating courses, tips on boating safety, and boating contests. Their Basic Boating Safety Course is approved by the National Association of State Boating Law Administrators (NASBLA) and recognized by the U.S. Coast Guard. The course can be taken on one's own schedule and pace. Help is available via email. There are three ways to take the Boating Safety Course:

- Study the material online, taking the online chapter review quizzes and final exam. The boater receives an email transcript upon completion and certificate and ID card sent via U.S. mail. Download the *digital version* of the course in a PDF file that can be viewed with the free Adobe viewer. The boater can study offline and go online to take the chapter review quizzes and the final exam. Boater receives an email transcript upon completion and certificate and ID card sent via U.S. mail.
- Order the *printed workbook* that includes the entire course, a companion disk with tutorials, all chapter review quizzes and the final exam. The boater can mail in the final exam (or take it online). Upon successful completion, boater receives certificate and ID card via U.S. mail.
- Boatsafe.com also offers a Coastal Navigation Course. This navigation course is a combination of home study materials, sample and real-time chart work, online testing, help desk and discussion board.

Boating Education for Kids

In recognition of the fact that boating is usually a family activity, many organizations offer boating education for children of various ages. The rationale underlying safety education targeted for youth is also based on the concept that lessons learned early in life will serve throughout one's lifetime. Examples include:

The U. S. Coast Guard Auxiliary's Boats 'n Kids course is a short one-hour presentation designed to teach 5- to 12-year-olds some basic safety tips around boats. The presentation includes a slide show demonstrating the right and wrong things to do around water and boats. There is also a short video showing the safe things to do around and in boats. Boats 'n Kids ends with a demonstration of how to put on a PFD (personal flotation device or life preserver) and what to do if someone else is in trouble in the water. Each child is given a workbook to help them remember what they have learned, including proper boat loading, safe fuel handling and basic safe boating tips. The Coast Guard Auxiliary also offers the Water 'n Kids course, a similar program designed for 4- to 7-year-olds.

- Boating Safety for Kids is offered by the US Power Squadrons concurrently with adult boating safety education courses, using different rooms of the same facility on the same evenings. This program was developed by USPS and Washington State Parks over a three year period with two years of test courses. (Jensen, 1999). The course is taught by two adults teaching as a team and is very hands-on. It is designed to appeal to children from ages 4 or 5 to early teens. The course focuses on needs for and how to wear pfds, how to keep weight low in boats, how to throw lines and flota-

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tion devices, dangers of hypothermia, and other life saving subjects.

- Boatsafe.com offers Boating for Kids to help young boaters (and young-at-heart boaters) to start boating safely and smartly.
- Boating Safety Sidekicks is a program of the National Safe Boating Council (NSBC). It includes booklets and online programs · (http://www. boatingsidekicks.com/).
- California's AquaSMART boating program offers curriculum materials for aquatic and boating safety education to public schools at no charge. During the current biennium, all elementary school curriculum materials were revised and the AquaSMART Water & Boating Safety series was developed. The series is divided into three parts, for grades K-2, 3-5, and 6-8. High school students are served by another boating safety program for grades 9-12. This information is also available on the AquaSMART webpage.

Instructor Training

Ensuring the quality of instructors is a critical element of the boating safety education system. A prime example of "training the trainers" is the National Safe Boating Council's (NSBC) Boating Safety Instructor Certification Course. The purpose of this training is to educate instructors on both the NASBLA Minimum Standards for Boating Education and on effective boating education methods. The NSBC Boating Safety Instructor Certification is designed to recognize the instructor candidate's prior training and experience plus completion of basic boating safety course work. The course objective is to identify and clarify the knowledge and skills needed to present an effective boating safety education curriculum to entry-level students. The course involves lecture, group discussion and a review of standards, textbooks, manuals and lesson plans.

Prerequisites of the NSBC Boating Safety Instructor program include current instructor level certification in a state or nationally recognized training program (or equivalent), a minimum of 40 hours teaching experience, and a high level of comprehension of the boating course content. This is a two-day, 16-hour boating safety review with written instructor exam. All materials, including five major boating safety manuals used in courses throughout the country and an NSBC instructor manual with disk of a model NASBLA safety course outline, is given to all registered instructor candidates. Upon successful completion of the course, the instructor receives an Instructor Certificate and an individual one-year membership to the National Safe Boating Council.

The learning outcomes of the instructor training program are as follows:

- Candidate will become familiar with the national course standards in boating safety education (NASBLA Minimum Standards for Boating Education).
- Candidate will be able to develop and present a course customized to local and regional requirements following the NASBLA Minimum Standards for Boating Education.
- Candidate will receive instruction and gain practical experience in developing and presenting a classroom-based boating course using proven education methods.

There are many other information sources for boating safety instructors as well, including the Boatus.com and BoatClass.com websites. In addition, many boating organizations provide a variety of services and professional development opportunities related to boater safety education.

Boating Industry Initiatives

Boating-related industries have played an important role in boater safety education. Both the industries themselves and their trade associations have been active players. For example, the Personal Watercraft Industry Association (PWIA) was formed in 1987 as an affiliate of the National Marine Manufacturers Association. It was created to bring together companies that manufacture or distribute personal watercraft (PWC) in order to promote safe and responsible operation of personal watercraft; and to work with federal, state and local agencies with regulatory responsibilities for recreational boating. The PWIA believes boating education makes sense for all boaters, not just PWC operators (http://www.pwia.org/). Because safety is of paramount importance, the PWC manufacturing industry has taken the following actions to raise awareness about proper PWC operation, behavior, courtesy and safety:

- All manufacturers provide extensive printed and video materials with every boat sold, and dealers routinely review safety techniques with their customers. The PWIA also developed classroom materials now used by more than 12 states, national organizations such as the U.S. Coast Guard Auxiliary and the U.S. Power Squadrons, and local boating enforcement agencies. Some PWC manufacturers also financially support safety education courses in public schools.
- The PWIA provides free rental education packages to PWC rental businesses. This package includes a

video, safety check-off list and printed safety literature.

- Manufacturing members of the PWIA are sponsors of the Personal Watercraft Rescue Specialists National Rescue School -- a training program for water rescue specialists.
- The PWIA strongly supports the Northwest PWC Safety Project. Watercraft dealers in Washington, Oregon and Idaho have banded together to promote safe, responsible use of PWC and other boats. Some of the tools dealers are utilizing as a result of this project are: code of ethics, dealer review safety list, window placard, wallet card, laminated list of safety rules, safety checklist and safety poster.
- To educate consumers and encourage safe PWC operation, Bombardier Recreational Products initiated its "Get Caught Doing It Responsibly" Demo Days program in key markets across the country. This largest ever interactive safety campaign reached thousands of current and future PWC enthusiasts with its "Boat Smart From The Start" safety message.
- Bombardier Recreational Products, with the National Marine Manufacturers Association, is a major corporate supporter of the Watercraft Training Centre in Canada.
- Kawasaki supported California State University Sacramento as its Aquatic Center developed the first University-accredited PWC education course. Kawasaki has worked with the Aquatic Center since 1995, providing Jet Ski® watercraft for the class; in 1998 this class was granted University accreditation. The 12-week course is open to students and the general public.
- Kawasaki's National Safe Boating Week program includes the donation of Kawasaki Jet Ski® watercraft and 650 life jackets in support of state and local programs in various localities.
- Kawasaki also supports the College of Search and Rescue program, which provides state-of-the-art training for all forms of rescue including swift water and ocean PWC rescue for emergency responders and law enforcement officials.
- Polaris introduced a PWC training program that requires dealers to deliver a boating safety presentation (video and law review) to all new purchasers. The product cannot be warranty registered until the customer receives information.
- Yamaha supports K-38, a personal watercraft rescue training company, which provides hands-on training for lifeguards, rescue agencies and law enforcement personnel.
- Yamaha donated $100,000 in personal flotation devices (PFD) and wet suits to the National Safe Boating Council for boating safety programs across the country. This apparel will be used for day loans at local recreation areas.
- Yamaha and the United Safe Boating Institute introduced a U.S. Coast Guard Auxiliary approved safety course for PWC owners. The certification program, developed through Yamaha's Get W.E.T. (Watercraft Education and Training) initiative allows Yamaha watercraft owners to review a short videotape presentation and booklet from home. They can take the certification test by calling a toll free phone number. The course is offered at no cost to Yamaha watercraft owners and takes about an hour to complete. Those who pass the certification process are automatically enrolled in Yamaha's Club Wave Owners Club entitling them to a USBI certificate, Club Wave membership card, insurance savings and club benefits that include special discounts on selected Yamaha watercraft accessories.
- Yamaha offers a NASBLA-approved, U.S Coast Guard-recognized boating safety course on its Club Wave website, www.yamahaclubwave.com.
- Yamaha has sent over 1,637 free rental kits to rental facilities since 1995. The kit consists of a Rental Tips booklet; an Instruction Poster highlighting key points of proper watercraft operation; Instruction Video; and Riding Card providing at-a-glance instruction reference, laminated for durability.
- To reinforce safe, appropriate and courteous operation of PWC, the industry helped develop and has actively supported reasonable boating regulations. More than 26 states have based their PWC laws on the PWIA Model Safety Act. This act addresses minimum operating age (16 years old), requires mandatory education of operators, prohibits nighttime and reckless operation, and requires all operators and passengers to wear Coast Guard approved life jackets, and to use their lanyard stop switches (for vessels so equipped). The PWIA strongly encourages all its members to abide by the PWC Code of Ethics.

Boating Education Standards

Standards for boating education in the United States fall under the jurisdiction of the National Association of Boating Law Administrators (NASBLA). NASBLA developed its minimum content for boating education courses more than a decade ago. These standards have served as a guide for state, non-profit and commercial providers to follow in developing boating education materials. In 1998, NASBLA began a research program in cooperation with the Pennsylvania State University to evaluate the existing guidelines and develop a new minimum "standard of care" for boating

for boating education. Relevant documents were reviewed and interviews were conducted with nationally prominent and recognized boating educators. A working draft of the standards was written and submitted to the NASBLA Standards Advisory Committee for review and comment. Several more drafts of the standards were completed, each going through a review process. The standards were intended to describe the minimum body of knowledge that should be included in a boating safety course in order to achieve safe, legal, and enjoyable boating. In addition, the proposed standard of care was predicated on reducing risk in recreational boating based on empirical accident and boating violation statistics.

In Phase Two of the research, the Penn State team sought to pilot test and evaluate the draft National Boating Education Standards. This work was divided into three tasks. Task 1 solicited the input of almost 150 boating educators representing major national boating organizations. This survey asked boating experts whether or not each proposed standard should be included as a minimum boating education standard, as well as the relative importance of each standard. Task Two involved a review of nine boating education course/texts using the draft standards. This task used volunteers who evaluated their own course materials against the standards, along with independent reviews by the research team and NASBLA representatives. The purpose of Task 2 was to validate the NASBLA function of reviewing boating courses submitted for NASBLA approval. Task Three of the evaluation sought to understand how instructors, presented with the draft standards, dealt with the design, implementation, and teaching of a boating safety course using these standards. In this task the purpose was to gain a deep understanding of the standards through intensive observations and discussions with boating educators who were actually using the standards. Each of the three tasks was structured to gain information that would be useful in finalizing the standards.

This work resulted in another revision of the National Boating Education Standards, which was adopted by NASBLA in September of 1999 (Hug et al., 1999). Through the national review and validation process, the National Boating Education Standards gained a high degree of national agreement. Table 3 shows a listing of the topics included in the NASBLA standards. These standards are intended to convey to organizations and individuals the **minimum body of knowledge that must be included in a short, 6-8 hour boating education course.** Boating instructors, text authors, boating professionals, and organizations are encouraged to go beyond the standards when, in their judgment and experience, it assists the boat operator to boat more safely. In addition, the standards are intended to show just the minimum content of the course materials, not the sequence or organization of the material. Although the standards are organized in a particular way, course/text developers are welcome to organize their information as they prefer.

It is noteworthy that environmental issues are included in the minimum knowledge that all boaters are expected to have (standards 5.1-5.3). But the boating education standards emphasize information related to boating safety and boat operation. Messages related to environmental stewardship may receive only cursory treatment in many boating courses due to the logistical difficulty of covering a large amount of required material within a limited amount of time and textbook pages.

Mandatory Education

More and more states are enacting laws requiring education for boaters. Some of these laws pertain to particular segments of boaters, such as youth or operators of personal watercraft. More than half of the states currently have some form of mandatory boating education, and other states have such legislation pending or proposed.

Nationally, a general consensus exists among boating safety educators and organizations that a reduction of recreational boating fatalities, injuries, and property damage might best be accomplished by mandating boat operators to participate in a boating safety course (Hug et al. 2000. The National Association of State Boating Law Administrators has endorsed the concept and prepared a model act for mandatory boating safety education. The Personal Watercraft Industry Association (PWIA) has also noted the trend towards mandatory education and has supported state initiatives to require education for operators of personal watercraft. Based on positive results from several states that already had some form of mandatory boater education, the PWIA introduced its own model act in 1998. Although evidence regarding the effects of mandatory education is sketchy, the PIAA cited the following examples in support of its position regarding mandatory education:

- **Connecticut** implemented mandatory education for most boaters and all personal watercraft operators

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Table 3. : Summary of Topics Included in NASBLA National Boating Education Standards

Section 1: The Boat

Standard 1.1 - Boat Capacities
Standard 1.2 - Boat Registration Requirements

Section 2: Boating Equipment

Standard 2.1 - Personal Flotation Device Types and Carriage
Standard 2.2 – Personal Flotation Device Sizing and Availability
Standard 2.3 – Wearing Personal Flotation Devices
Standard 2.4 - Personal Flotation Device Serviceability
Standard 2.5 - Fire Extinguishers
Standard 2.6 - Back-Fire Flame Control Device
Standard 2.7 – Ventilation Systems
Standard 2.8 – Navigation Light Equipment
Standard 2.9 - Sound Signaling Equipment

Section 3: Trip Planning and Preparation

Standard 3.1 - Checking Local Weather And Water Conditions
Standard 3.2 - Checking Local Hazards
Standard 3.3 - Filing a Float Plan
Standard 3.4 - Boat Preventative Maintenance
Standard 3.5 – Transporting and Trailering
Standard 3.6 - Fueling Procedures
Standard 3.7 - Pre-Departure Checklist & Passenger Communication

Section 4: Marine Environment

Standard 4.1 – Environmental Laws and Regulations
Standard 4.2 - Human Waste Disposal
Standard 4.3 – Disposal of Toxic Substances

Section 5: Safe Boat Operation

Standard 5.1 - Operator Responsibilities
Standard 5.2 - Influence of Drugs and Alcohol on Boat Operation
Standard 5.3 - Navigation Rules of the Road
Standard 5.4 - Aids to Navigation
Standard 5.5 - Docking and Mooring
Standard 5.6 - Anchoring

Section 6: Emergency Preparedness

Standard 6.1 - Rendering Assistance
Standard 6.2 - Communication Procedures
Standard 6.3 - Capsizing Emergencies
Standard 6.4 - Falls Overboard Emergencies
Standard 6.5 - Hypothermia Prevention
Standard 6.6 - Fire Emergency Preparedness
Standard 6.7 - Running Aground Prevention and Response
Standard 6.8 - Accident Reports
Standard 6.9 - Boating Accident Report Form

Section 7: Other Water Activities

Standard 7.1 – Personal Watercraft and other Jet Propelled Watercraft
Standard 7.2 - Water Skiing
Standard 7.3 - Diving and Snorkeling
Standard 7.4 - Hunting & Fishing

Section 8: Boating Education Practices

Standard 8.1 - Continuing Education
Standard 8.2 - State Specific Boating Information

Source: http://www.nasbla.org/education_standards.htm

in 1993. Since 1995, the number of reported accidents involving PWC has remained fairly constant (six accidents in 1995, eight accidents in 1998), however the amount of PWC registered in the state has grown by approximately 30 percent. Frank Disbrow, supervisor of Connecticut's boating division, reports that an additional benefit of mandatory education has been fewer complaints regarding PWC. He states that while complaints used to come in to his office daily, he only received three complaints in 1998 and hadn't received any complaints as of May 1999.

- In October 1996, **Florida** established its mandatory education law. It requires all persons born after September 30, 1980 to complete a NASBLA approved boater education course or competency exam prior to operating a vessel powered by a motor of 10 horsepower or more. On October 1, 2001, all persons 21 years of age and younger will be required to comply with this law. According to boating law administrator Jim Brown, Florida has seen a downward trend in the percentage of reported accidents in the 16 and under age group since the law was established. In 1996, the 16 and under age group was responsible for 14 percent of reported accidents involving PWC. By 1998, the percentage of reported accidents from this age group had dropped to 12 percent. "It is a good sign," he says of the official statistics. "In reality, the percentage of accidents from this age group dropped to about 10 percent in 1998." He bases this on what he calls the "double-edge sword of education," meaning that as more people receive boating safety training and learn about the accident reporting requirements, more accidents get reported. Brown said another positive aspect of the law is that adults are completing the course along with their children. He feels this helps account for the fact that the number of PWC accidents has remained stable, even though more craft have been registered every year since the law took effect. In fact, PWC accidents have dropped about 15 percent since 1995, while the number of registered PWC increased over 31 percent.
- In January 1995, **Kansas** began requiring mandatory education for PWC operators between the ages of 12 and 15. Boating Law Administrator Cheri Swayne reports that PWC accident figures involving youths under 19 dropped dramatically since then. During 1998, 12.5 percent of PWC accidents involved youths, a significant drop from the 35.3 percent involvement in 1997. Overall, PWC accidents decreased significantly during 1998. In 1997, PWC accidents comprised 56.1 percent of the total accident figure; PWC involvement dropped to 39.8 percent in 1998 - a decrease of over 16 percent, while PWC registration numbers during the same time increased 11.5 percent.
- In **Maryland**, which enacted mandatory education regulations in the mid-1990s, the number of PWC registered in the state increased from 9,273 in 1995 to 14,365 in 1998, an increase of almost 55 percent. During the same time, the amount of PWC-related accidents increased by approximately 7 percent, with 56 PWC accidents reported in 1995 and 60 PWC accidents in 1998. Maryland officials also note that they had no PWC-related fatalities in 1996 or 1997, and only one fatality in 1998, down 50 percent from the two fatalities recorded in 1995.
- **New Jersey's** mandatory education program began in 1997. Under state law all PWC operators must complete a boating safety course and carry an operator's certificate. The program has been an overwhelming success. According to state officials there were 68 accidents, 53 injuries and one fatality reported to the state in 1998 in comparison to the pre-law statistics for 1996 of 89 accidents, 55 injuries and three deaths. This corresponds to approximately a 24 percent decrease in accidents, a four percent decrease in injuries and a 67 percent decrease in fatalities. These decreases are significant in light of the fact that PWC registrations in New Jersey increased during this time as compared to the number registered in 1996.
- **Utah** continues to see reductions in the number of reported PWC accidents, despite the fact that the number of personal watercraft registered in the state has risen since the implementation of mandatory education in 1995. Utah requires mandatory education for operators between the ages of 12 and 17. The results for this targeted age group are highly significant. Accidents involving 12 to 17-year olds dropped by almost 72 percent since 1995. While education is only required for youths, the benefits are not confined to that age group. Since 1995, PWC registration increased almost 40 percent, yet accidents involving PWC decreased by about 18 percent. Fatalities involving PWC have dropped as well, with two recorded in 1998 as compared to four recorded in 1995. This amounts to a 50 percent reduction in fatalities. Ted Woolley, boating law administrator for Utah is "proud of the statistics" and a firm believer in mandatory education. "We have proof it works," he said and notes that these reductions were achieved, "even though a new insurance requirement went into effect last year that increased the reporting of accidents."

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Testing Issues

The trend toward mandatory boating education has raised many difficult questions relative to the implementation of the required education. Thus, Phase Three of NASBLA's research on National Boating Education Standards addressed several questions related to testing boater knowledge, including:

- What does evidence from educational research literature tell us about learner acquisition of boating knowledge in distance learning courses versus classroom instruction?
- Is there any evidence from educational research that suggests there is a difference in boat operator knowledge demonstrated on a course exam versus an equivalency exam?
- What does evidence from educational research, mandated boating education states, and comparable fields, tell us about the differences between proctored and non-proctored exams in classroom and distance learning settings (such as the Internet).
- What research information exists about whether boating safety exams should be approved independently or in conjunction with a course of study?
- Should there be a national pool of exam questions from which approved tests are constructed?
- What information can be provided to boating educators and NASBLA course reviewers on designing and evaluating high quality tests of boat operator knowledge.
- How many exam questions should be allocated to each standard to assure that the boat operator is tested adequately on each standard?
- What kinds of questions (true/false, multiple choice, fill-in blank, etc.) are most effective at testing boat operator knowledge on exams?

To address these questions, Hug et al. (2000) examined educational research literature and explored education practices in fields comparable to boater education. They found no evidence of significant differences in knowledge acquisition between traditional classroom formats and distance learning or self-study programs. Most of the studies reviewed found no significant differences between alternative formats, and those finding differences showed no consistent pattern (Russell, 1999; Schulman & Sims, 1999; Wade, 1999). In some cases traditional classroom settings showed stronger results, and in other instances the distance education alternatives were superior.

Experts in educational testing recommend that a well-designed exam should have a variety of types of questions and cover the entire body of knowledge as outlined by the National Boating Education Standards. Certain standards, however, carry more importance and should receive more attention within the exam.

The boating community is divided in beliefs about whether boating safety exams must be proctored. Some states and organizations require proctored exams and others do not. The main reasons to proctor an exam are to make sure that the test is secure from theft and to assure that the test taker is actually the person who has attainted a high degree of content knowledge. In high stakes testing situations, such as entrance into college or obtaining a professional license (doctor, lawyer, pilot, commercial boat captain, etc), the ability to successfully pass a knowledge exam provides the test taker with the right to attain a privilege. Through legislation society determines what professions necessitate a higher level of prerequisite knowledge before gaining a professional privilege, and test security is matched to that knowledge-testing purpose.

Boating test security should be appropriate for the exam purpose and context of the test. Exam security might include procedures such as: confirming the identity of the test taker, randomizing test items, using different versions of an exam, observing test takers during the exam, protecting the security of the test item answers, using distinctive, hard to duplicate certificates, maintaining test taker records, etc. There is no single exam security protocol that would fit all boating safety examinations.

Even with the highest levels of test security, ingenious test takers find ways of cheating. No matter what exam security measures are followed, as the stakes (fees, consequences for failure) increase, the possibility of losing exam integrity increases. Fortunately, in most cases, learning recreational boat safety is easier than cheating on the examination.

From their research, Hug et al. (2000) recommended adding several additional standards to the approved NASBLA boating education standards:

> Standard 9.1 - Boat Operator Knowledge Course Formats. The course submitted for NASBLA review may be in any format that meets the standards as long as it can be reviewed easily by NASBLA. These may include but are not limited to classroom instruction, distance learning, or self-study programs.
>
> Standard 9.2 - Boat Operator Knowledge Exams. In order to receive NASBLA approval, all exams,

whether administered as part of a course of study or as independent exams, must be submitted for review.

Standard 9.2.1 -The exam must be well designed and comprehensive in covering NASBLA's standards for boat operator knowledge. Well designed comprehensive exams assess boat operator knowledge equally well as an independent exam or as an exam at the end of a course.

Standard 9.2.2 - Each exam submitted for review must be accompanied with a plan that explains how the test administrator will seek to **maintain exam integrity**. The plan must address security issues commensurate with the purpose of the test and perceived opportunity to commit exam fraud.

Other Examples of Best Practices

The above discussion has identified the major components of boater safety education in terms of key boating organizations and agencies. It is also useful to consider the various types of practices that cut across the organizations and providers. The following approaches have been used frequently within boater safety education programs in the United States.

Videos

There are many excellent videos on various aspects of boating safety. Videos can be used in the classroom, at home, or even online. They can enhance an instructional program or be the means of conveying the entire program. Besides the many examples of videos mentioned earlier, some notable examples include:

- "Judgement on the Water – Sportsman Version" is an instructional video designed for all sportsmen—both fisherman and hunters – who use small boats, often on cold water and in inclement weather. It combines Small Boat Safety for the Fisherman and Small Boat Safety for the Hunter into one video that has a great deal of life-saving information for this large and at-risk segment of the small boat using public. Roughly 12-1/2 minutes long, the video is directed to a segment of the boating public that has been challenging to reach - anglers and hunters. Sportsmen and women are an important target for boating safety education and information. Unfortunately, most do not identify themselves as boaters. This video speaks directly to them by capturing their attention with graphic and gripping images and action. It is highly successful in bringing the boating safety message home to this group. The video is short enough to use during a formal meeting, banquet, or casual presentation or it can be used as a stand-alone program at an exhibit booth (available through special arrangement between the National Safe Boating Council and Alan Madison Productions).
- The state of Utah mailed a video about personal watercraft safety to every household in the state with a registered PWC (about 7,000 copies). This is a good example of aggressively providing an educational program to a boating segment that has been identified with a high need for safety education.

Practice Exams, Quizzes, and Pretests

It has been documented that people learn material by taking tests without prior study (Hug et al. 2000). Many boating websites include practice tests that boaters can take at any time to prepare for a certification test or just learn about boating safety.

- The Boat Ed website offers a boating safety course Pre-Test. The site suggests that, even though you may have been boating for a long time, you can still learn something new about boating safely and the boating laws in your state.

Loaner lifejackets for kids

Many places have instituted programs providing life jackets for kids. These programs recognize that failure to wear personal flotation devices (PFDs) is a leading cause of boating fatalities. They attack the problem directly by making suitable PFDs available and indirectly through the educational message that PFDs must be age-appropriate and must be worn to be effective.

- Texas has a cooperative program with BOAT/U.S. to provide loaner life jackets for youngsters (*Small Craft Advisory* 14 (5): 19).
- Colorado has a similar program. "A properly sized life jacket can be the difference between survival and tragedy for a child that falls in the water," said Ron Dunlap, Boat Safety Coordinator for Colorado State Parks." The intent of the program is to make sure kids, especially young kids, have properly fitting life jackets while they are boating." (from website)
- South Dakota's Department of Game, Fish & Parks offered loaner personal flotation devices that fit infants and toddlers (*Small Craft Advisory* 14 (5): 19).

Mascots

Mascots are often used at community events or boating-related special events. This is a popular means of targeting children for boating safety messages. Some examples include:

- Lenny the Lake Lizard – this costume is available from the Boating Safety Section of New Mexico's State Parks agency (who adapted the idea from Arizona).
- Charley the Police Boat reminds youngsters about the importance of boating safety (a cooperative effort between state of Oregon and U.S. Coast Guard Auxiliary, and FWP).
- Theodore Tugboat (National Safe Boating Council) travels to different areas and events. It includes a complete online activity center.
- Bobby the Boat (Michigan) is a remote controlled electronic robot used for teaching elementary school students boating and water safety. Bobby the Boat has working navigation lights, horns, siren, blue emergency light, an AM/FM cassette, and a remote speaker and microphone system. Bobby is capable of holding a conversation with an audience without the audience being able to see the operator. The average presentation lasts about an hour and consists of how to safely do a water rescue without the rescuer going into the water and the importance of wearing a life jacket (PFD). Students are taught to reach for a victim, throw a life preserver or go for help, but never go into the water to perform a rescue.

Incentives

Incentives are an increasingly popular method of rewarding or recognizing good examples of safe boating behavior.

- Many insurance companies offer discounts on boat insurance to individuals who successfully complete boating safety courses. This is a strong incentive for boaters to seek formal boater education.
- In Ohio, boaters wearing PFDs received floating key chains, while kids got a "junior watercraft officer" badge.
- Alabama has a cooperative program with McDonalds that offered youngsters wearing pfds coupons for free French fries.
- Louisiana's "I got caught wearing my lifejacket" program offered boaters a free t-shirt.
- In North Carolina, t-shirts and stickers were given to youngsters wearing PFDs. In addition, glow sticks were given to boaters who did not have proper lighting equipment and needed to return to shore after dark.
- The Michigan Department of Natural Resources, in cooperation with AAA of Michigan, Stearns Manufacturing and Wellington Water Sports, held a drawing for a free pfd for young boaters. Michigan conservation officers handed out postage paid drawing cards to boaters during the boating season. A drawing was held during the boating season and the winner received a free PFD delivered by a conservation officer. For an opportunity to win a free PFD, boaters were advised to contact a Michigan conservation officer on the water during the boating season.
- Alaska's Boating Safety Program offers free posters and bumper stickers featuring the 2001 National Safe Boating Campaign theme, "Boat Smart from the Start - Wear your Life Jackets."

Research Needs

While boating-related agencies and organizations throughout the U.S. are currently following many "best practices for boater safety education," more research is needed to document the effectiveness of various practices. At present, the best practices are defined primarily in terms of consensus of professional judgment or frequency of use. Relative to the current NASBLA boating education standards, further study is needed to assist the development of "boat operator knowledge exam quality criteria." The current standards use terminology such as "well-designed comprehensive exam." These terms need to be defined and described thoroughly to assist boating education course and test designers with the review process. This research should address questions such as:

- What is the purpose of boat operator knowledge exams?
- What are the characteristics of high quality exam questions?
- How many questions should be on a well-designed comprehensive exam of boat operator knowledge?
- How many questions should cover each section of the required NASBLA standards?
- What type (multiple choice, true/false, etc.) of questions should be used on an exam?
- How do you establish test validity?
- How do you establish test reliability?

In its most recent annual conference (September, 2000), the National Association of State Boating Law Administrators passed a formal resolution (Resolution 00-1) calling for a Comprehensive Boating Safety Needs Assessment. This resolution was intended to stimulate research providing the U.S. Congress with a complete picture of what is needed to advance boating safety in the next 10 years, and was forwarded to the U.S. Coast Guard for their consideration and appropriate action. NASBLA also passed Resolution 00-5, calling for research on Exposure Hours of Recreational Boaters. This resolution recognized the importance of understanding the amount of time various types of watercraft spend on the water and the inconsistency in previous studies examining the role of exposure hours in explaining boating accidents and fatalities. Research is needed to document variation in exposure levels by state and whether such variances have a direct effect on the frequency of accidents. Educational efforts can then be developed to further reduce the frequency and consequences of boating accidents.

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(http://www.pwia.org/Safety.htm)

SafetyNet: U.S. Department of the Interior (DOI) http://safetynet.smis.doi.gov/contactsA.htm#watercraft

United States Power Squadrons: http://www.usps.org/

United States Coast Guard: http://www.uscg.mil/

Defining Best Practices in Boating, Fishing, and Stewardship Education: Challenges and Opportunities for Reaching Diverse Audiences

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Abstract – This paper draws on the social science literature on race, ethnicity and outdoor recreation to propose how "best practices" for boating, fishing, and stewardship education might be defined. It begins with an overview of a framework for arriving at best practices that consider marginality, subcultural, assimilation, interpersonal discrimination and institutional discrimination factors. Each of these factors has been shown to have distinct effects on recreational participation and all require vigilance to overcome. Seeking input from diverse audiences at all phases of program planning and service delivery can trouble shoot problems before programs are implemented. Input also could be sought through periodic focus groups sessions or through establishing formal channels with advisory groups.

Introduction

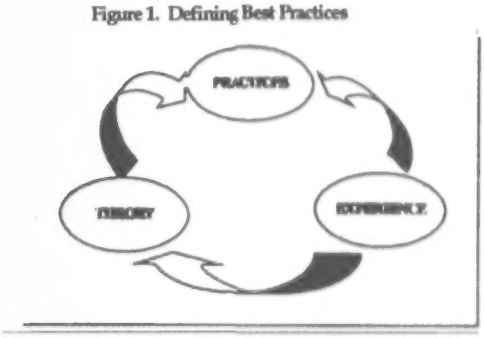
Over the past decade fisheries managers have become more knowledgeable of the motivations and social benefits associated with fishing, boating, and stewardship education. In large measure, their knowledge has been enhanced by research on the human dimensions of fisheries management (e.g., Holland and Ditton, 1992). Also, over the past decade, there has been growing awareness among managers and researchers that substantial segments of the population encounter barriers and constraints to participation in boating and fishing and that opportunities for these activities may not be equally accessible to a broad segment of the American population (Henderson, et al. 1989; Gramann, 1996).

Indeed, a growing body of social science research indicates that compared to the majority population, racial and ethnic minority groups are less likely to participate in many forms of natural resource-based recreation activities and are especially less likely to participate in water-based recreation (Dwyer, 1994; Floyd, 1999; Gramann, 1996). The disparity in participation between the majority and minority population is a major concern among resource managers for at least two important reasons. First, racial and ethnic minority populations, particularly Hispanic populations, will dramatically increase their share of the U.S. population over the next several decades. In the State of Texas, the current population characterized as "minority" will become the "majority" population by 2020 under a variety of population growth scenarios (Murdock et al., 1997). Second, and related, if current recreation preferences and rates of participation of persist into the future, the probability of lower demand for resource-based activities of interest to fisheries, boating, and stewardship professionals increases. Hence, in the public sector at least, the cost of providing fishing, boating and stewardship education opportunities may be borne increasingly by a smaller share of the population. This impact could be particularly severe in regions or states with substantial racial and ethnic minority populations.

There is research evidence that indicates that recreation behaviors, like other social behaviors, result in part from parental and community socialization during childhood and early adolescence. For example, a series of community studies by John Kelly (1974, 1977) found that two-thirds of all adult activities learned during childhood persist through adulthood. More recently, Scott and Willits (1989, 1998) analyzed survey data originally collected from individuals in 1947 and again from the same individuals in 1992. They found that the frequency of participation in a variety of recreation activities (socializing, formal organizations, intellectual activities, sports, and art) were positively correlated with participation in these activities much later in life – 45 years in the latter 1998 study! Studies of outdoor recreationists have also revealed that early childhood or adolescent participation predicts involvement in later life (e.g., O'Leary, Dottavio, and McGuire. 1987).

In recent years a number of outdoor "socialization" programs have been implemented to teach outdoor skills in order to stimulate involvement in outdoor sports such as fishing and hunting. One of the most visible programs targeted women is *Becoming An Outdoors-Woman* (Hall, 2000). In the State of Texas, Texas Parks & Wildlife administers a grant program, the Community Outdoor Outreach Program (COOP), which provides money to non-profit organizations at the "grass-roots" level to provide outdoor education for under-served populations. These kinds of efforts are being duplicated around the country to meet the challenges

Figure 1. Defining Best Practices



and opportunities presented by a society that is becoming increasingly diverse. To mount an effective campaign to increase involvement of racial and ethnic minorities in fishing, boating, and stewardship education, "recruitment and retention" strategies should be anchored in both theoretical and experiential knowledge. In other words, boating, fishing, and stewardship *education* should be supported by scientific literature and experiences from professionals in the field. As these practices are "field tested" the results can be used by other professionals and by researchers to better understand the factors associated with participation in boating, fishing, and stewardship education as defined by theory, practice, and experience (Figure 1).

This paper draws on the social science literature on race, ethnicity and outdoor recreation to propose how "best practices" for boating, fishing, and stewardship education might be defined. It begins with an overview of a tentative framework for arriving at best practices. Next, methods of evaluation for gauging effectiveness for education programs for diverse audiences are briefly reviewed. In the concluding section, gaps that exist in the literature that limit understanding and professional practices associated with boating, fishing, and stewardship education are presented. Recommendations for future research are also outlined.

A Framework for Defining Best Practices

What follows is a tentative guiding framework for defining best practices in boating, fishing, and stewardship education. The framework provides a heuristic tool for developing strategies for reaching racial and ethnically diverse audiences. In some cases, existing education program and services already incorporate elements of this framework. In other cases, opportunities for developing new educational strategies might be suggested.

Racial and ethnic influences on outdoor recreation participation have been viewed from four theoretical perspectives. These perspectives constitute the basis of the proposed framework shown in Figure 2. The key assumption, examples of empirical indicators, and examples of existing or potential practices are shown for each perspective.

Marginality Factors

The marginality hypothesis was developed to explain low participation in wildland recreation among African-Americans (Washburne, 1978). It holds that low rates of participation among African-Americans result from limited access to socioeconomic resources that, in turn, result from historical patterns of racial discrimination. Stated differently, historical barriers in education and employment have negatively affected earnings that in turn affect disposable income available for recreation opportunities. Practices guided by this perspective would attempt to remove or lessen socioeconomic barriers that constrain access.

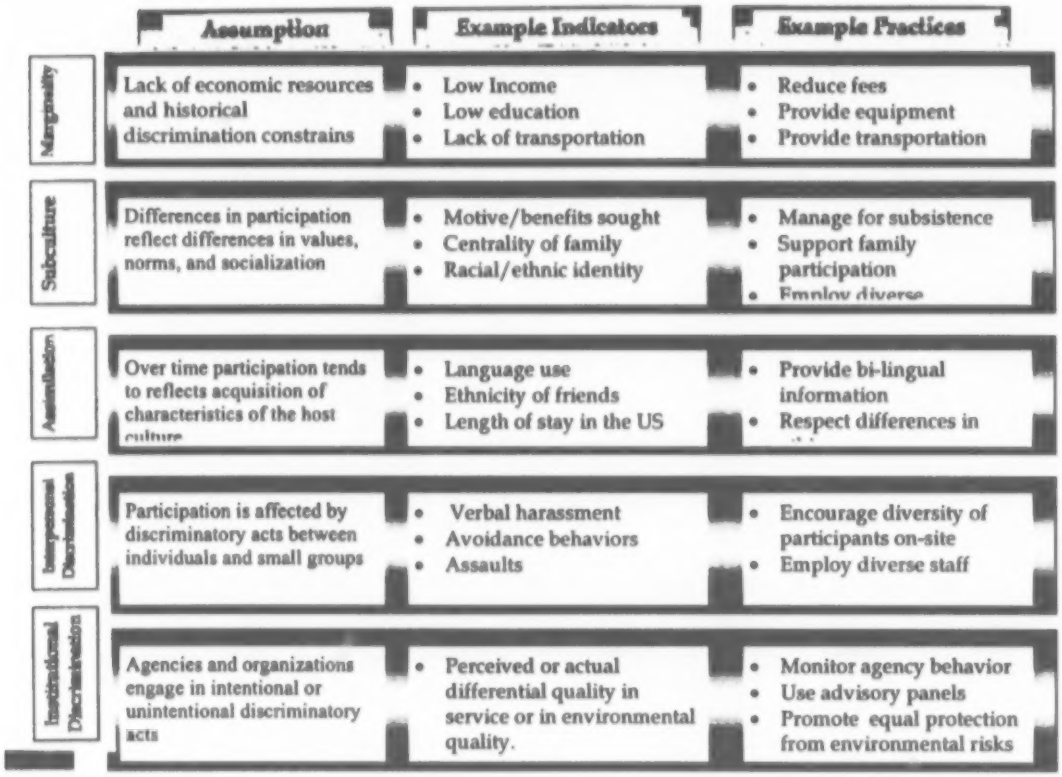
Current data on household income by race and ethnicity show significant gaps between White, non-Hispanics and African-Americans, Hispanics and American Indians and Alaska Natives (Table 1). While there are no significant differences between White, non-Hispanic and Asian/Pacific Islander households, incomes for African-American, Hispanic, and American Indian households lag behind, with African-American households earning less than all other groups. Therefore, income is a significant barrier to consider in planning education programs, particularly for less affluent African-Americans.

Table 1 -- Household Income by Race and Ethnicity: 1999 Median Income

Race/Ethnicity	Median Income (dollars)
White	44,366
Black	27,910
Hispanic	30,735
Asian and Pacific Islander	51,205
American Indian	30,784

Source: U.S. Census Bureau, Current Population Reports P60-209, Money Income in the United States: 1999, U.S. Government Printing Offices Washington, D.C. 2000

Figure 2.
A Framework for Defining Best Practices for Fishing, Boating and Stewardship Education



Examples of educational practices developed to help individuals surmount "marginality factors" include those that are offered for free or at reduced costs, provide necessary equipment and gear, or transportation. Scott, Floyd, Pepper and Callahan (1998) found that most recipients of Texas Parks and Wildlife's COOP used the funds for purchasing equipment, transportation, admission fees, salaries, and other program costs. Increasing opportunities for urban fishing opportunities, with special emphasis on young anglers, represents an important strategy related to marginality concerns. In 2000, 53% of all African-Americans in the U.S. lived in the central cities of the largest metropolitan areas.

Clearly, outreach efforts such as the Texas-based KIDFISH program must assume a larger role in reaching urban minority communities. Targeting all Texas youth, KIDFISH is the result of a partnership involving the Parks and Wildlife Foundation of Texas, the Sharelunker Foundation, and Texas Parks and Wildlife (TPW News, 1998). KIDFISH provides grants to local communities to introduce youth to fish through hands-on fishing experiences. The program also requires grant recipients to show how their proposals increase access to fishing opportunities. Communities have used the grants for conducting angler education sessions, construction of fishing piers and educational signs, and other improvements to infrastructure for increasing access.

Since racial and ethnic minorities to comprise a "majority" share of the largest metropolitan areas in Texas and other states, programs like KIDFISH must be adapted to appeal to racially and ethnically diverse audiences. There are opportunities to partner with local "grass-roots" to accomplish the goals of boating, fish-

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ing, and stewardship education. For example, a community-based organization located in Dallas known as the Inner City Fishing Institute, founded and directed by Mark Cole, engages African-American youth in fishing and boating education. The Inner City Fishing Institute teaches fishing and boating skills. It also emphasizes how the act of fishing connects with the ecology, academic achievement in math and science, and overall community well being.

Subcultural Factors

While marginality factors direct attention to socioeconomic constraints, the subcultural hypothesis states that racial and ethnic differences in outdoor recreation participation can be attributed to different norms, beliefs, values systems and socialization practices adhered to by different racial and ethnic groups (Washburne, 1978). According to this perspective, cultural factors rather than socioeconomic constraints are more significant in explaining recreation participation among minority groups. Hence, practices guided by this perspective would attempt to reflect the culture of those being served. Subcultural factors can influence participation in boating, fishing, and stewardship education in several important ways.

First, the pathway into boating, fishing, and stewardship education is leisure socialization. Being taught "how to" precedes any involvement in any activity. Acquiring skills, learning the satisfactions and outcomes, and internalizing the meanings of activities result from the socialization process (Kelly, 1983). Most recreation activities are taught and learned within the intimate confines of home and family (1987). The influence of culture is likely to be strongest in this setting. Why? Decisions about leisure are made in relative freedom and are less subject to conformity pressures found in work, school, or other settings. Therefore, it is more likely that ethnic differences will be reflected in choices of leisure activities initiated in family contexts (Gramann, Floyd, & Saenz, 1993). Such influences do not necessarily lead to non-participation or low participation. In many instances, differences in *style* of participation may result. In other words, fishing may take on different meanings for different groups; different groups may prefer different approaches or techniques; or for some ethnic groups fishing may be a core cultural activity as is the case for many American Indians and Native Alaskan people (Burger, 2000).

For example, Toth and Brown (1997) studied racial differences in motivations for fishing among Blacks and Whites in two communities in the Mississippi Delta. The salience of "subsistence" motivations among African-Americans and "for sport" motivations among Whites was a key difference between these groups. They concluded, "different groups have unique histories particular to their experiences in the Mississippi Delta and thus multiple motivations and meanings for fishing" (p.141). Among some African-Americans, generally, fishing may be associated with recollections of the more positive aspects of rural living.

The importance of family in Hispanic culture and its influence on outdoor recreation behaviors has been documented by several studies (e.g., Simcox & Pfister, 1990; Bass, Ewert, & Chavez, 1993; Gramann et al., 1993; Shaull & Gramann, 1998). Based on a telephone survey of Phoenix residents, Gramann et al. (1993) reported that Mexican-Americans rated "doing something with family" and "doing something with children" higher as motives for outdoor recreation than White, non-Hispanic respondents. Likewise, Simcox and Pfister (1990) and Bass et al. (1993) found that both U.S.-born and Mexican-born Hispanics rated being with family significantly higher than White, non-Hispanics. The importance of family among Hispanic recreationists is usually reflected in the size and composition of recreation groups (Gramann, 1996). That Hispanic recreation group sizes typically exceed those of Whites and African-American is well documented (Carr & Williams, 1993; Hutchison & Fidel, 1987; Irwin, Gartner, & Phelps, 1990). Hutchison (1996) has documented the importance of family leisure participation among the Hmong, an ethnic group with origins in Southeast Asia.

Educational practices sensitive to cultural influences as described might include opportunities for family participation and opportunities that support or reinforce cultural identity. The subcultural perspective might also suggest that program staff (especially professional staff) include members of racial and ethnic groups being served.
Planning fishing and boating education activities as part of established ethnic community activities (e.g., festivals) when possible rather than sponsoring "stand alone" agencies events can send a positive message to minority communities. The latter approach (i.e., "stand alone events") could be labeled as paternalistic and condescending, especially when it might appear that racial and ethnic minorities are characterized as deficient in their knowledge of outdoor activities.

Assimilation

A number of studies have used assimilation theory to understand the role of ethnicity in recreation behavior. Assimilation refers to "the process of boundary reduction that can occur when members of two or more societies meet" (Yinger, 1981: 249). Two types of assimilation have been examined in recreation research:

cultural assimilation (also known as acculturation) and structural assimilation. These concepts have been applied to permit closer observation of subcultural factors.

Cultural assimilation refers to minority group acquisition of cultural characteristics of the majority group (or host society) such as language, diet, and religion (Gordon, 1964). A commonly used indicator of cultural assimilation is language use: to what extent do minority group members used their native language versus English. Structural assimilation refers to the extent of social interaction between majority and minority groups in primary (e.g., family and friendships) and secondary (e.g., school, work, etc.). The key assumption associated with this perspective is that greater assimilation leads to similarity between majority and minority group members. In general, studies of Mexican-American recreation suggest that cultural assimilation is more important in predicting choices of activities while primary group assimilation is more important in understanding site choices. In relation to boating, fishing, and stewardship education, these findings indicate that decisions to participate in these activities are likely to be influenced by cultural factors; decisions about where to participate are subject to primary group influences.

Trends in immigration are particularly relevant to assimilation. Immigration (and descendants of immigrants) is projected to account for "approximately three-fifths" of the U.S. population growth through 2050 (Murdock, 1995). Asia and Latin America account for 84% of immigrants to the U.S. (Murdock, 1995). Thus the vast majority of "new Americans" come from countries where English is not the primary language and where Western European traditions do not form the foundation of societal culture. This fact has direct implications for stewardship education.

Stewardship activities in the U.S. are based primarily on European-North American views of nature. Traditionally, such views make a sharp separation between of "man" and nature (Cronon, 1996). In the case of resources such as wilderness, parks, and other protected areas, stewardship activities aim to limit if not remove the the influence of humans. A number of writers have shown that Native Americans (McDonald and McAvoy, 1997), Latinos (Lynch, 1993) and African ethnic groups (Burnett & Conover, 1989) do not compartmentalize and separate nature from human. Using Lynch's (1993) terminology, Western ideal landscapes are pristine and untouched; for Latinos, ideal landscapes are peopled and productive. She argues that traditional resource management practices may ignore the needs of Latino anglers:

> Livelihood issues are important to U.S. Latino populations. Concern about limitations on the recreational bluefish catch in Atlantic coastal waters is one such example. Yet even this debate shows the distinction between 'recreation' and 'livelihood' is a slippery one. The joy of going out onto the ocean to wrestle with the feisty bluefish comes from contact with nature, but seeking that joy may be justifiable only when it can bring benefit to the collective. Giving fish to family and neighbors may legitimate as well as intensify the natural experience. How different this is from the Anglo ideal, where the ultimate destination of the fish is unimportant compared to the contest itself (p. 117).

In this case, Latino anglers in New York supported marine conservation while arguing that recreational catch restrictions limit their ability to use their catch as an occasion to show generosity to family and friends. For these anglers, environmental ethics are linked to social networks, composed of family friends and neighbors (Lynch, 1993).

Interpersonal Discrimination

Interpersonal discrimination refers to actions carried out by members of dominant racial or ethnic groups that have differential and negative impact on members of minority group members (Feagin, 1991). Such actions take place between individuals or in small group situations. For example, racial slurs directed at a family of Korean-American anglers because of their ethnic background or avoidance behavior on the part of White recreationists when multiple families of African-Americans enter a campground are examples of discrimination at the interpersonal level.

Does interpersonal discrimination influence participation in fishing, boating, and stewardship education?[1] Researchers have yet to examine this question directly. Research conducted in other recreation settings offers some clues. For example, in a study of Chicago's Lincoln park, Gobster and Delgado (1993:78) reported that discrimination "has affected 1 in 10 minority users." African-Americans, followed by Hispanic-Americans and Asian-Americans, were most likely to report acts of discrimination. These acts included verbal harassment,

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[1]In my own experience, I attribute learning to swim later in life to my mother's belief that "White men" had something to do with the drowning death of her brother in the 1950's. She discouraged participation in swimming and boating for this reason.

physical gestures, assaults, nonverbal cues, and harassment from law enforcement officers. A focus group conducted by Wallace and Witter (1992) revealed that a significant number of African-Americans in St. Louis did not camp because they felt vulnerable to racial intimidation. Floyd, Gramann, and Saenz (1993) found that perceptions of discrimination among Hispanics in Phoenix tended to decrease visits to 8 of 13 sites on the nearby Tonto National Forest. Most of the sites offered fishing and boating opportunities (e.g., Lower Salt River, Saguaro Lake, Canyon Lake Recreation Area, Apache Lake Recreation Area). Finally, a study set in the Detroit area found that African-American visits to regional parks were negatively affected by interracial conflicts with white park users.

The extent to which interpersonal discrimination carries over to fishing, boating, and stewardship education is not known. There is enough empirical evidence on this issue, however, to suggest that it could be a factor. As the nation becomes more diverse there is more opportunity for interracial and inter-ethnic contact. Managers and providers of boating, fishing, and stewardship education must be aware of the social climate their settings engender. Do they make members of different ethnic groups feel welcome? Settings with racially and ethnically diverse participants and staffs are very likely to attract diverse audiences. For example, Taylor (1992) found that African-Americans preferred to use parks that other African-Americans were also using.

Institutional Discrimination

The final perspective to introduce is *institutional* discrimination. Rather than drawing attention to individual and interpersonal interactions, institutional discrimination focuses on the "behavior" of organizations, bureaucracies or corporate entities. This behavior can be intentional (which is clearly illegal) or unintentional with equivalents outcomes. In other words, unintended institutional discrimination can have negative consequences. How does this work? Feagin and Eckberg (1980) developed two concepts that illustrate this form of discrimination: side-effect discrimination and past-in-present discrimination. Side effect discrimination "involves practices in one institutional or organizational area that have an adverse impact because they are linked to intentionally discriminatory practices in another" (p. 13). For example, historically, discrimination in housing and mortgage lending contributed to residential segregation in U.S. cities around the country (Massey & Denton, 1993). This situation has contributed to the practice of redlining in other industries. Redlining refers to the practice of not doing business in low-income, inner city minority communities. While such practices have been reversed in large measure, they have residual effects. A commonly observed outcome is the migration of potential tax revenues and concomitant services (recreational and otherwise) to affluent suburbs.

Past-in-present discrimination leads to similar outcomes. It refers to "apparently neutral present practices whose effects derive from prior intentional discrimination practices" (Feagin & Eckberg, 1980). Recreation resource management policies that are informed primarily by the opinions of past and current users have the potential result in discriminatory outcomes. Consider this hypothetical example. Imagine a region where the population is quite diverse ethnically, and where there is strong demand for subsistence fishing. A stocking program that caters to mostly white, traditional sport anglers while benignly neglecting the preferences of minority recreationists who fish for sport and subsistence would exhibit "past-in-present discrimination" described by Feagin and Eckberg.

Environmental justice can also be related to institutional discrimination. Environmental justice refers to the inequitable distribution of environmental protection across communities defined by race, ethnicity, or income. Beginning in the 1980's several studies reported that racial and ethnic minorities were disproportionately exposed to environmental hazards (Mohai & Bryant, 1992). In fact, several studies have shown that racial and ethnic minorities are particularly vulnerable to risks associated with catching and consuming fish caught in contaminated waters (Burger et al., 1999; Heatwole & West, 1985; West, 1992; West, Fly, Larkins, & Marans, 1992). Such findings have led social justice advocates to charge management and regulatory agencies with environmental racism (Shanklin, 1997).

How public agencies, particularly federal agencies and their cooperators, should respond to claims of environmental injustice or racism can be found in Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." Directives in the Executive Order which speak directly to risks associated with fishing include: (a) identification of differential patterns of consumption among minority and low-income populations; (b) collection, maintenance and analysis of information on consumption patterns dependent on fish and/or wildlife for subsistence; (c) communication of known risks associated with consumption to the public; and (d) ensuring that communications are accessible and can be understood (Executive Order No. 12898, 1994).

How should knowledge of these forms of institutional discrimination shape boating, fishing, and stewardship education practices? In abstract, yet real terms,

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vigilance is critical. Being alert to impediments, barriers, or constraints associated with historical patterns of discrimination is a very practical matter. Seeking input from diverse audiences at all phases of program planning and service delivery can "trouble shoot" problems before programs are implemented. Input could be sought through periodic focus group sessions or through establishing formal channels (e.g., "community advisory councils"). Regarding environmental justice issues, for programs targeting minority communities where subsistence fishing is practiced, risk communications should be prominently featured. Risk information should especially target immigrant communities where English is not the primary language.

Evaluation Methods for Best Practices

Systematic evaluation of education programs and outreach effort is necessary for determining whether educational program objectives are achieved. This section is concerned with identifying methods for gauging effectiveness of education programs associated with boating, fishing, and stewardship. It provides a brief review of five methods for collecting data that can be used to make judgments about program effectiveness: surveys, focus groups, ethnographic methods, longitudinal studies and experimental designs. Also, the section poses the question of how program effectiveness success should be defined.

Survey Methods

Much of the research on racial and ethnic minority recreation participation is based on survey samples, either on-site or off-site using telephone or household interviews. On-site interviews with minority participant is an effective means of gaining information such as extent of fishing and boating activity, social group size and composition, and other participation characteristics. On-site survey samples exclude non-participants however. While there is interest in both populations, there may be greater interest in stimulating participation among non-participants.

Population surveys of national, regional or statewide scope on the other hand can be designed to include subgroups of participants and non-participants. Population surveys allow researchers to determine specific rates (as percentage of the population) of boating, fishing, and involvement in stewardship activities. Large population studies are necessary for establishing trends and baseline information. Data from the National Survey on Recreation and the Environment and National Survey of Fishing, Hunting, and Wildlife-Associated Recreation are important for this reason. Results from population surveys also tend to be generalizable.

Conducting surveys of minority populations in urban, inner- city can be difficult however. Minorities who live in inner-city areas are generally regarded as "hard-to-reach" populations with characteristically low response rates (Pottick & Lerman, 1991).

Focus Groups

Focus groups are being used more frequently in outdoor recreation research as an alternative and as a complement to surveys. They can be an effective means of collecting data on outcomes associated with educational practices. Focus groups consists of a small number of individuals assembled to discuss a topic of interest to a researcher or to an agency. Focus groups produce qualitative data through a focused discussion among individuals who may possess some common attributes (Krueger, 1988). Krueger (1988) gives several advantages of the focus group method: (1) it allows the interviewer to probe; (2) they are usually not expensive; and (3) they provides timely results. The major disadvantages are that data derived from the discussion may be difficult to analyze and problems with logistics, getting individuals together and finding a setting conducive for conversation (Henderson & Bialeschki, 1995).

The U.S. Army Corps of Engineers Waterways Experiment Station has experienced success in using a series of focus groups to gain insight into African-American and Native American water-based recreation preferences (see Dunn, 1998; Dunn & Feather, 1998). The department of Texas Parks and Wildlife has also used this method to gauge minority participation in outdoor activities (Hall, 2000).

Ethnographic Methods

Another alternative to "quantitative" surveys is the ethnographic method. Ethnographic research differs from traditional survey research by placing the researcher inside of the community being studied. The advantage of having an insider's view is being able to see how a leisure activity, such as boating and fishing, is connected to the daily patterns and routines of an ethnic community. This approach to evaluation holds potential for understanding how members of ethnic communities define fishing, boating, and stewardship in relation to their own culture. Information gathered in this way can be used to tailor programs to meet needs of particular ethnic communities. Success with this approach depends on four factors: (1) the ability of a researcher to establish an identity within an ethnic community; (2) the project must originate with community need rather than an agency priority; (3) recognition that relationships are the most important task in the process; and (4) remem-

bering that community members are the experts on the own culture (McDonald and McAvoy, 1997).

Longitudinal Studies

Program evaluations should employ longitudinal designs to track participation over time and to observe long-term changes in behavior. Longitudinal designs rely on panels, a fixed number of individuals who respond to queries over time (e.g., weeks, months, or years) (Churchill, 1991). In contrast, cross-sectional studies are based on measurements taken at only one point in time. The greatest advantage of a longitudinal design, as stated, is the ability to examine enduring participation in an activity. As Scott and Willits (1989, 1998) demonstrated, panel studies provide opportunities to study recreation involvement of group of individuals over several decades. Disadvantages of this design approach include the effort required to recruit and retain individuals. Mortality, in terms of refusals to participate in subsequent measures, change of residence, death, and other factors, also are disadvantages. This approach however appears most effective for evaluating long-term participation in fishing and boating.

Experimental Methods

Experimental methods are arguably the most effective tools for determining whether a specific intervention leads to a particular outcome. Henderson and Bialescksi (1995) describe experimental studies as "the classic example" of evaluation. In controlled laboratory experiments, the effect of manipulating an independent variable on a dependent or outcome variable can be observed while the effects of other relevant factors are minimized. As they suggest, however, many variables of interest such as skill development, attitudes, and program leaders cannot be controlled and manipulated in experimental designs. While tightly controlled experiments are difficult to employ, field experiments are conducted in realistic or natural settings. Field experiments appear more suitable for relating the effects of educational program components to boating, fishing, and stewardship outcomes.

A major advantage of experimental designs is that the variables in question must be made operational specified prior to the study (Babbie, 1989). In survey research, it is common to collect large amounts of data and then identify operational definitions "after the fact." Developing a priori definitions forces researchers and sponsors to consider what particular outcomes are most relevant for evaluation. Apart from the technical aspects of program evaluation, having to define the meaning of "effectiveness" or "success" may cause agencies and program providers to reflect more deeply on the goals of boating, fishing, and stewardship education. This may serve to clarify an agency's mission with regard to educational practices and may result in a higher level of service for the public.

Knowledge Gaps

There is very little research on racial and ethnic minority group involvement in boating, fishing, and stewardship education. Although the literature on minority involvement in general outdoor recreation is quite substantial, most of this research has focused on land-based recreation (Gramann, 1996). The following statements represent major gaps in the literature and outlines future research needs:

- Compared to other ethnic communities, there is virtually no information on how immigrant populations respond to the fishing, boating, and stewardship education activities. There are opportunities to examine how assimilation processes affect preferences for boating, fishing, and stewardship education.

- Among racial and ethnic groups generally, and among those where English may not be the primary language spoken, there are no studies that demonstrate the most effective ways of communicating stewardship messages. Research on white populations suggests that communications-based management approaches are effective in reducing rule violation (Gramann, 1996).

- Interpersonal discrimination in other recreation settings has been documented. It is not known to what extent this type of discrimination affects participation in water-based activities. In addition, there is little information on how different groups respond to discrimination experiences.

- Subcultural factors (particularly socialization) are important predictors of participation. It is generally assumed that these factors are unique across different ethnic groups. There have been no studies to examine how individuals from different acquire fishing, boating, and stewardship skills and attitudes. How different are the pathways into fishing and boating across ethnic groups?

- Methodologies for evaluating minority involvement in boating, fishing, and stewardship educations should be developed. Although these activities can occur in different types of environments (e.g., marine vs. freshwater fishing), there is some commonality in the underlying components of these activi-

ties (e.g., the presence of water). Opportunities should be sought to explore the design of "standardized" (to the extent possible) approaches around common environmental components. Moreover, longitudinal approaches are needed.

- Research should focus on the agencies and organizations that provide boating, fishing, and stewardship education and not only the audiences being served. History clearly demonstrates that agencies can engage in discriminatory actions. Studies that could possibly reveal institutional barriers (often unintentional) that block minority participation are needed.

- Environmental justice has become an important concern in natural resource management. This is a particular concern in regions where boating and fishing occur in waters contaminated with hazardous materials. Future research should continue to monitor the extent to which minority boaters and anglers are exposed to hazardous materials. Studies should also examine the effectiveness of stewardship education in increasing awareness of these risks.

- There is a need to clearly specify the goals and measurable outcomes associated with boating, fishing, and stewardship education. Clear specification of goals and outcomes is needed.

Summary and Conclusions

This paper attempted to offer some direction for defining best practices in boating, fishing, and stewardship education. Several theoretical concepts were drawn from the outdoor recreation literature on race and ethnicity. These concepts were presented as a tentative guiding framework for planning educational practices for minority populations. The paper also provided an overview of data collection methods used in evaluation research. Finally, a broad outline of research needs was identified. As racial and ethnic diversity increases, strategies will be required to make boating, fishing, and stewardship accessible to the widest segment of the population. This paper sought to provide assistance to researchers and practitioners in this worthwhile effort.

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AN OVERVIEW OF AN ISSUE AND ACTION INSTRUCTION PROGRAM FOR STEWARDSHIP EDUCATION

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Abstract – The purpose of this paper is to summarize an issue instruction environmental education program developed by Harold Hungerford and his associates over the past three decades. The primary focus of the issue instruction program is on the development and application of investigation and evaluation skills to environmental problems and issues. Program materials take a structured approach to the development of these skills and encourage the teacher to become a guide and facilitator during the skill application. The paper documents the development of various program elements and summarizes related research used to further refine and extend the program.

Preface

Early in the development of this paper and document, I expressed some reservations about the term and concept "best practices." I would like to briefly summarize my concerns here as a short preface to this paper.

To begin, it should be acknowledged that "best practice" is one of several terms that now appear in the literature and in informal use. Several other terms in use include "standard practice," "sound practice," and "common practice." Holsman (2001) refers to common practices as those that are commonly used in a given field. Common practices are usually practical (i.e., they have worked in practice over time), and have some traditions associated with their use. Further, it is often assumed there is some type of research base to them, whether or not that is true. Professionals (or fields) can get into trouble with common practices when tradition overrides the absence of research, or worse, when research runs contrary to assumptions related to those practices. For example, in EE, many have assumed that the Raths-Harmon-Simon approach to values clarification is supported by research, despite a careful review of this body of the research that clearly indicates otherwise (Lemming, 1985).

Next, I'd suggest that the term "best practices" cannot be easily applied to aquatic resource education (ARE) or environmental education (EE). First, from a research and evaluation perspective, the evidence base in the fields of ARE and EE is limited in its ability to support strong claims about the value of many of our practices (and programs). In some cases this research has not been done and, in cases where it does exist, it has not been fully synthesized. This makes it difficult for professionals in ARE and EE to justify or defend their claims about what works (best) using anything other than what Michael Quinn Patton refers to arguments of intrinsic value. In the current atmosphere of accountability, intrinsic arguments carry far less weight than do data based ones.

Second, from a practical perspective, teachers and other educators know that practices (or programs) that work best for one population of learners in one place at one point in time may not be best for another population of learners in another place and/or at another time. This view is embedded in much of the qualitative research in education (e.g., field and case studies). Even in quantitative research, researchers concede this point when they indicate that some practices are more robust or generalizable than others (i.e., there is a narrower or wider range of populations and settings in which practices are determined to be useful). It takes a substantial amount of research, development, and evaluation work on a given practice to support claims that it has, in fact, been found to be useful for a variety of populations in a variety of setting (e.g., the extensive body of work and research on cooperative learning). Few practices (or programs) in EE have received this kind of systematic attention. For this reason, it is noteworthy that the professional educators associated with the program featured in this paper have worked hard to address these needs and concerns for more than 25 years.

Further, the terms standard practice and sound practice have been used in a variety of ways. For example, standard practice can refer to the standardization of a given practice for the sake of consistency from place-to-place and time-to-time (i.e., from a technical perspective). In this sense, a practice may or may not have either an evaluation or a research base that support its use. To overcome this weakness, Holsman (2001) defines standard practice in a narrower sense: "Standard

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fines standard practice in a narrower sense: "Standard practices are hereby defined as 'those teaching or educational strategies which appear to yield desired outcomes if applied under a certain set of conditions, and with age appropriate audiences as demonstrated by research and evaluation." Similarly, for the purposes of this paper, I will define sound practice as meeting two criteria implicit in this discussion: (a) from a practical perspective, a program may be considered sound if its design, delivery, and evaluation work well to help learners accomplish specified goals and objectives; and (b) from a research and evaluation perspective, a program may be considered sound if there is a well developed body of evidence to document and support (a). Thus, Holsman's definition of standard practice and this definition of sound practice appear to address similar criteria and concerns.

Given the apparent disadvantages of "best practices," I will close by indicating a preference for either "standard practices" or "sound practices" as defined above. Both terms, as defined, suggest that a practice (or program) has been clearly defined, refined through repeated delivery, and supported by a substantial body of evidence. Still, both terms leave unanswered important questions regarding the extent to which any practice (or program) can be generalized to new populations and settings; these questions should always be open to scrutiny. I believe that the ideas expressed in this preface are important for those involved in boating, fishing and stewardship education, and leave it to readers to consider them as they read this paper and document.

Model Used to Organize and Illustrate This Paper

The purpose of this paper is to summarize a particular Environmental Education (EE) program. Unfortunately, this purpose and the format of this document do not permit me to adequately present this program. The best way to do that would be to arrange for readers to become involved in or to directly observe training sessions and classroom implementation, or perhaps to view any number of taped workshop and classroom segments. Consequently, other approaches must be used to summarize this program. The two that are most common in the literature and that will be used throughout this paper are narrative summaries and graphic organizers. An attempt will be made to enrich these with the use of quotes and selected samples from program-related materials, studies, and articles.

The graphic organizer or model that I have used to organize this paper and will use to illustrate this program must be described in some detail (Figure 1). Dr. R. Ben Peyton of the Department of Fisheries and Wildlife at Michigan State University presented an earlier version of this model in his work with Aquatic Resource Education (ARE) programs in Northeast and Mid-Atlantic states. He used that version of this model to help State ARE Coordinators explore the distinctions between "Outcomes" and "Benefits," and the common tendency for program administrators to select ARE program "Tools" before determining ARE program "Purposes." Since 1997, I have evolved the version of the model that now appears in Figure 1.

A number of factors have contributed to the graphic model that appears in Figure 1, notably advances in the field of program evaluation: (a) where there is an increasing use of the terms "Outputs," "Outcomes," and "Impacts" to distinguish among different kinds of program results (Rossi, Freeman and Lipsey 1999); and (b) where this is increasing interest in and attention to logic modeling to graphically depict key assumptions about and features of programs that have evolved a theory and evidence base (McLaughlin and Jordan 1999; Rossi, Freeman and Lipsey 1999; Rogers 2000). A brief description of these should help readers better understand the nature of the graphic model in Figure 1.

Outputs, Outcomes, and Impacts

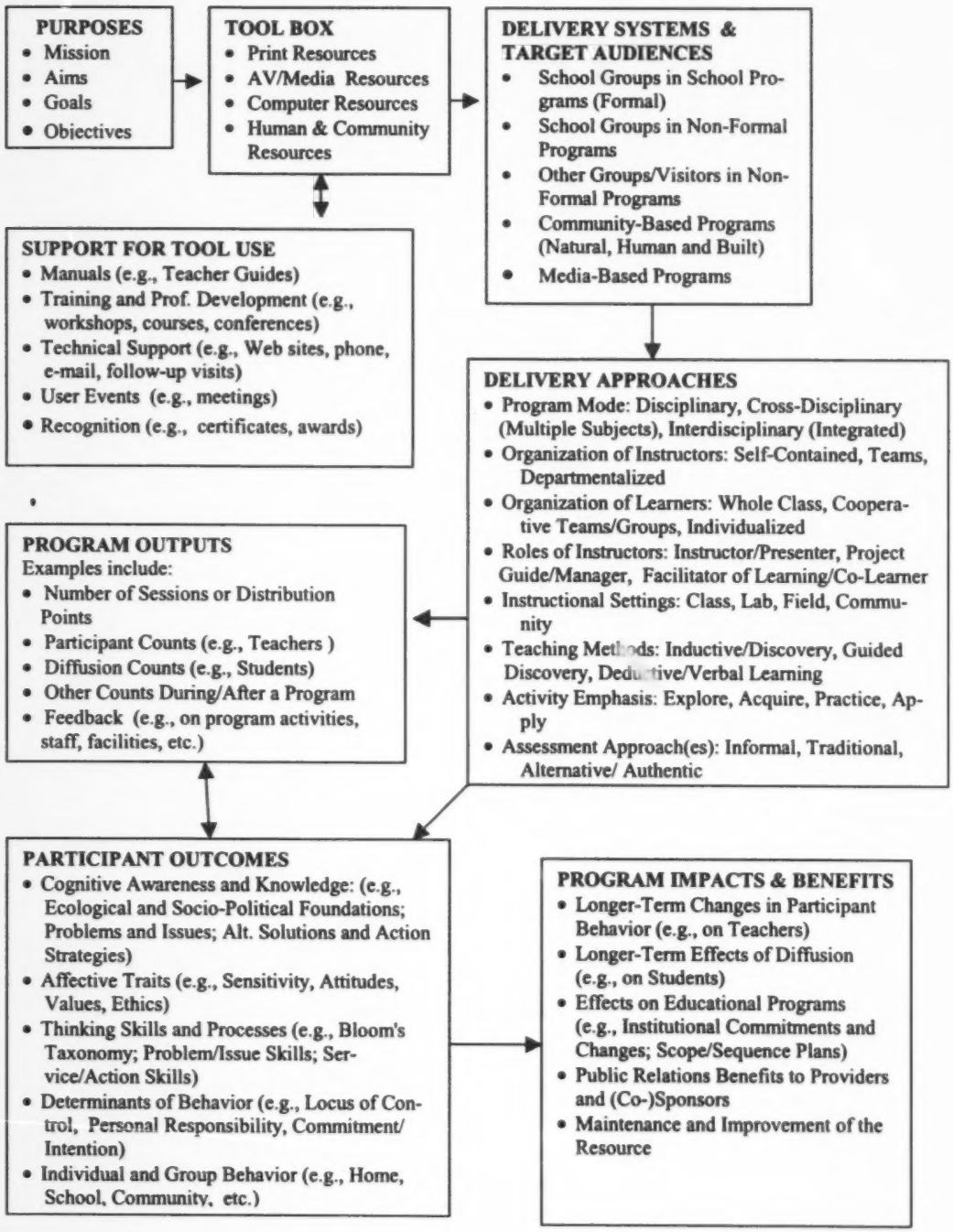
Allow me to describe how the three terms from (a) above are used with respect to the model in Figure 1. To begin, Rossi, et al. (1999) describe the difference between outputs and outcomes.

> In particular, performance measurement schemes distinguish program outcomes from program outputs. Program outputs are the products or services delivered to program participants or other such activities viewed as part of the program's contribution to society. Measures of output, for example, would relate to such things as the number of clients served, the number of service units provided, costs per service unit, the quality of services provided, the nature and volume of advocacy or promotional efforts made by the program, and so forth. (pp. 201-202, underlining added)

Thus, outputs refer to: (a) number counts associated with the delivery of a program, such as those traditionally requested by federal and state agencies; and (b) the quality of the delivered program, as is traditionally determined through formal and informal feedback mechanisms (e.g., satisfaction surveys).

In contrast, Rossi, et al. (1999, p. 202) describe outcomes as the more immediate results of program activity

Figure 1 – A General Logic Model for Resource Education Programs


PURPOSES
• Mission
• Aims
• Goals
• Objectives
TOOL BOX
• Print Resources
• AV/Media Resources
• Computer Resources
• Human & Community Resources
DELIVERY SYSTEMS & TARGET AUDIENCES
• School Groups in School Programs (Formal)
• School Groups in Non-Formal Programs
• Other Groups/Visitors in Non-Formal Programs
• Community-Based Programs (Natural, Human and Built)
• Media-Based Programs
SUPPORT FOR TOOL USE
• Manuals (e.g., Teacher Guides)
• Training and Prof. Development (e.g., workshops, courses, conferences)
• Technical Support (e.g., Web sites, phone, e-mail, follow-up visits)
• User Events (e.g., meetings)
• Recognition (e.g., certificates, awards)
DELIVERY APPROACHES
• Program Mode: Disciplinary, Cross-Disciplinary (Multiple Subjects), Interdisciplinary (Integrated)
• Organization of Instructors: Self-Contained, Teams, Departmentalized
• Organization of Learners: Whole Class, Cooperative Teams/Groups, Individualized
• Roles of Instructors: Instructor/Presenter, Project Guide/Manager, Facilitator of Learning/Co-Learner
• Instructional Settings: Class, Lab, Field, Community
• Teaching Methods: Inductive/Discovery, Guided Discovery, Deductive/Verbal Learning
• Activity Emphasis: Explore, Acquire, Practice, Apply
• Assessment Approach(es): Informal, Traditional, Alternative/ Authentic
PROGRAM OUTPUTS
Examples include:
• Number of Sessions or Distribution Points
• Participant Counts (e.g., Teachers)
• Diffusion Counts (e.g., Students)
• Other Counts During/After a Program
• Feedback (e.g., on program activities, staff, facilities, etc.)
PARTICIPANT OUTCOMES
• Cognitive Awareness and Knowledge: (e.g., Ecological and Socio-Political Foundations; Problems and Issues; Alt. Solutions and Action Strategies)
• Affective Traits (e.g., Sensitivity, Attitudes, Values, Ethics)
• Thinking Skills and Processes (e.g., Bloom's Taxonomy; Problem/Issue Skills; Service/Action Skills)
• Determinants of Behavior (e.g., Locus of Control, Personal Responsibility, Commitment/ Intention)
• Individual and Group Behavior (e.g., Home, School, Community, etc.)
PROGRAM IMPACTS & BENEFITS
• Longer-Term Changes in Participant Behavior (e.g., on Teachers)
• Longer-Term Effects of Diffusion (e.g., on Students)
• Effects on Educational Programs (e.g., Institutional Commitments and Changes; Scope/Sequence Plans)
• Public Relations Benefits to Providers and (Co-)Sponsors
• Maintenance and Improvement of the Resource

ties, described in terms of the effects of these activities on program participants (e.g., increased awareness and skill). For educational programs such as ARE and EE programs, outcomes refers to the more immediate learning outcomes in the cognitive, affective, psychomotor, and/or behavioral domains that may be observed at the end of a program (e.g., gains related to any of the Tbilisi Objectives; Unesco, 1977). The measurement of outcomes is typically referred to as the assessment of learning or of learning outcomes (Iozzi, Laveault, and Marcinkowski 1990).

Lastly, Rossi, et al. (1999), describe impacts as part of their discussion of program impact theory.

> The central premise of any social [or environmental] program is that the service it delivers to the target population induces some change that improves social [or environmental] conditions. The program impact theory is the set of assumptions embodied in the program about how its services actuate or facilitate the intended change. Program impact theory, therefore, is causal theory: It describes a cause-and-effect sequence in which certain program activities are the instigating causes and certain social [or environmental] benefits are the effects they eventually produce. (p. 102)

Given this, impacts may be defined as longer-term effects or benefits that result from the activities in a particular program (e.g., long-term effects on program participants, tangible benefits to educational programs and providers). The measurement of impacts is sometimes referred to as impact assessment or impact evaluation. For example, with respect to ARE and EE programs, longer-term, cumulative effects may accrue from learners' repeated exposure to natural environments through recreational activities such as canoeing and fishing (Sward and Marcinkowski 2001). Similarly, benefits of teacher in-service programs may extend from teacher-participants to the schools or programs in which they work (e.g., longer-term curricular change), and in some instances even to the natural environment (e.g., resource stewardship).

Program Logic and Logic Models

The ability to tie a particular set of program activities to learning outcomes and then to longer-term impacts in a convincing cause-and-effect manner requires a substantial amount of work to link theory, research, practice, and evaluation. Attempts by program evaluators to do so for a particular program lead to what they call program theory or program logic for that program.

> A critical aspect of program theory is how the various steps and functions [of a program] relate to each other. Sometimes those relationships involve only the temporal sequencing of key program activities and their effects ... In other cases, these relationships have to do with activities or events that must be coordinated ... Other relationships entail logical or conceptual linkages, especially those represented in program impact theory.... Describing program theory, therefore, requires an understanding of how different events, persons, functions, and other elements represented in the theory are presumed to be related. (Rossi et al. 1999, pp. 171-172).

In evolving their ideas about program theory and program logic, some program evaluators have come to view programs from a systems theory perspective (i.e., as consisting of inputs, throughputs, and outputs). For any given program, they work to identify necessary inputs (e.g., people, resources, internal and outside factors), throughputs (e.g., program activities), and their relationship to desired outputs (i.e., as described above, as outputs, outcomes, and impacts). As they identify these elements and relationships, they construct and make explicit the logic within that program. They refer to the set of established, apparent, and hypothesized relationships among these elements as program logic.

More specifically, Funnell (1997, as cited in Rossi et al. 1999, p.172), McLaughlin and Jordan (1999), Rogers (2000), and others have described the elements and relationships that are central to program logic. Funnell (1997) identified the first of these as the cause-and-effect hierarchy of desired program outputs that lead to immediate outcomes, and in turn to longer-term impacts. Other central features of program logic identified by these writers include: factors internal and external to a program and program activities that are likely to influence these outcomes/impacts, means for defining and measuring these outcomes/impacts, actual program performance data pertaining to these outcomes/impacts, and means for interpreting these performance data.

The graphic depiction of these elements and the relationships for a given program is commonly referred to as a logic model.

> A rather common way of depicting the organizational plan [or logic] of a program is in terms of inputs, representing the resources and constraints applicable to the program, and activities, indicating the services the program is expected to provide.

> When included in a full logic model, these schemes typically represent receipt of services ... as program outputs, which, in turn, are related to desired outcomes. (Rossi et al. 1999, p. 111).

In addition to serving as communication devices, logic models may also serve as heuristic devices; that is, they allowing and even encourage a variety of questions inherent in program logic and program evaluation to be raised and addressed. Rossi et al. (1999) identify a number of questions that may be posed as part of a review of the logic and plausibility of a program:

- Are the program goals and objectives well defined?
- Are the program goals and objectives feasible; i.e., is it reasonable to assume that they can actually be attained as a result of program action?
- Is the change process presumed in the program theory plausible?
- Are the program procedures for identifying members of the target population, delivering service to them, and sustaining that service through completion well defined and sufficient?
- Are the constituent components, activities, and functions of the program well defined and sufficient?
- Are the resources allocated to the program and its various components and activities adequate? (pp. 178-180)

Use of Logic Models in This Paper

I will use the term logic model in two related ways. First, I will refer to the graphic depiction of elements and relationships in Figure 1 as a general logic model. As a general model, it reflects common features of educational programs in the U.S., but does not include all elements central to program logic and logic modeling (e.g., factors internal and external to a given program). The elements of this general logic model are:

- Educational Purposes, which includes aims, goals and objectives;
- Educational Tools, which includes curricular materials;
- Support Systems for Use of Those Tools: which includes manuals, training, and technical support;
- Delivery Systems, which includes sectors and target audiences;
- Delivery Strategies, which includes the means and methods used to deliver education and information programs and activities;
- Outputs, which are program-related number counts and feedback;
- Outcomes, which are learning outcomes for program participants;
- Benefits or Impacts, which are longer-term program payoffs.

Second, I will refer to the graphic depictions of the EE program featured in this paper as program-specific logic models (Figure 2 and Figure 3). The use of general and program-specific logic models should help to make explicit the evolving logic inherent in this program, and allow it to be compared to other programs in the fields of ARE and EE.

Introduction to the Program Featured in This Paper

This paper will summarize a program directly related to the stewardship emphasis of this document. This program is the issue and action instruction program developed by Dr. Harold Hungerford and his colleagues affiliated with Southern Illinois University at Carbondale (SIU-C) and, more recently, the Center for Instruction, Staff Development, and Evaluation (CISDE). The initial curriculum they have been evolving since 1973 is now entitled Investigating and Evaluating Environmental Issues and Actions (IEEIA) (Hungerford, Litherland, Peyton, Ramsey, & Volk 1988, 1990, 1992, 1996). This and related curricula will be described in a section of this paper entitled "Issue and Action Instruction Curricular Materials."

These curricular materials have been designed for use in formal school programs, although some of them have been adapted for use in non-formal programs (e.g., extended summer programs offered by an environmental center; see Jordan, Hungerford and Tomera, 1986). With respect to their target audience, the original issue and action materials were designed for use at the middle/junior high level. As will be described later, this curriculum was permutated for use in upper elementary grades (i.e., as "extended case studies"), and most recently for use at the secondary level. Under "Delivery System" (Figure 1), these are the audiences within the formal and non-formal sector targeted by this program.

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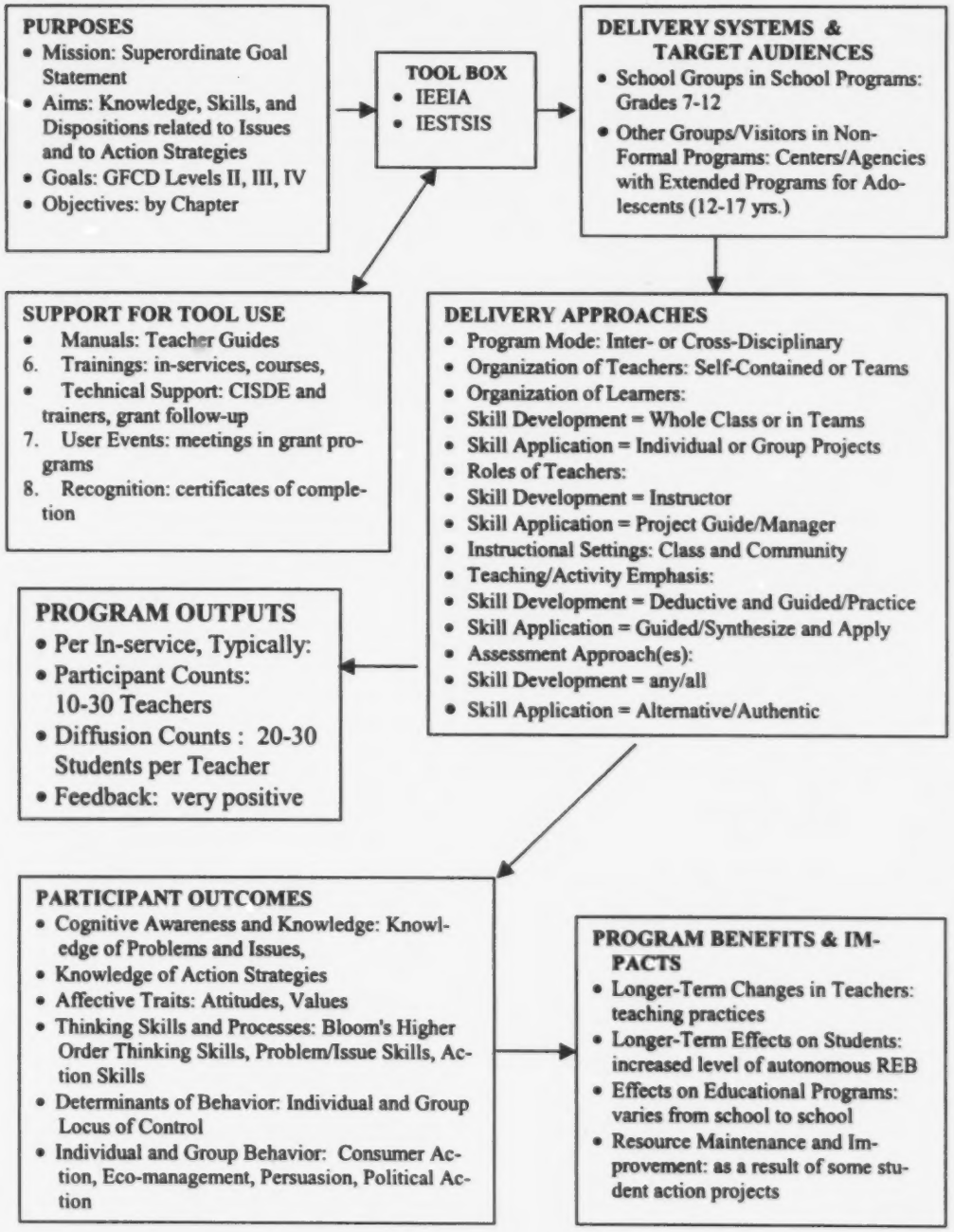
Figure 2. A Program-Specific Logic Model for IEEIA and IESTSIS


PURPOSES
• Mission: Superordinate Goal Statement
• Aims: Knowledge, Skills, and Dispositions related to Issues and to Action Strategies
• Goals: GFCD Levels II, III, IV
• Objectives: by Chapter
TOOL BOX
• IEEIA
• IESTSIS
DELIVERY SYSTEMS & TARGET AUDIENCES
• School Groups in School Programs: Grades 7-12
• Other Groups/Visitors in Non-Formal Programs: Centers/Agencies with Extended Programs for Adolescents (12-17 yrs.)
SUPPORT FOR TOOL USE
• Manuals: Teacher Guides
6. Trainings: in-services, courses,
• Technical Support: CISDE and trainers, grant follow-up
7. User Events: meetings in grant programs
8. Recognition: certificates of completion
DELIVERY APPROACHES
• Program Mode: Inter- or Cross-Disciplinary
• Organization of Teachers: Self-Contained or Teams
• Organization of Learners:
• Skill Development = Whole Class or in Teams
• Skill Application = Individual or Group Projects
• Roles of Teachers:
• Skill Development = Instructor
• Skill Application = Project Guide/Manager
• Instructional Settings: Class and Community
• Teaching/Activity Emphasis:
• Skill Development = Deductive and Guided/Practice
• Skill Application = Guided/Synthesize and Apply
• Assessment Approach(es):
• Skill Development = any/all
• Skill Application = Alternative/Authentic
PROGRAM OUTPUTS
• Per In-service, Typically:
• Participant Counts: 10-30 Teachers
• Diffusion Counts : 20-30 Students per Teacher
• Feedback: very positive
PARTICIPANT OUTCOMES
• Cognitive Awareness and Knowledge: Knowledge of Problems and Issues,
• Knowledge of Action Strategies
• Affective Traits: Attitudes, Values
• Thinking Skills and Processes: Bloom's Higher Order Thinking Skills, Problem/Issue Skills, Action Skills
• Determinants of Behavior: Individual and Group Locus of Control
• Individual and Group Behavior: Consumer Action, Eco-management, Persuasion, Political Action
PROGRAM BENEFITS & IMPACTS
• Longer-Term Changes in Teachers: teaching practices
• Longer-Term Effects on Students: increased level of autonomous REB
• Effects on Educational Programs: varies from school to school
• Resource Maintenance and Improvement: as a result of some student action projects

Origins of This Issue and Action Instruction Program

This program and the curricular materials associated with it began in 1972 when Mr. Ralph Litherland, a middle grades science teacher, asked Dr. Harold Hungerford, a science education professor, for assistance. Mr. Litherland was attempting to involve students in multiple sections of his course in investigations of community problems and issues. He found it difficult to facilitate individual investigations for a large number of students without first equipping them with the thinking and inquiry skills to do so. They found that:

> ... middle school students are ill-prepared to research environmental problems using primary or secondary sources of information (or both). Early attempts to provide a learning climate in which normal middle school students could apply their own environmental interests to a research-oriented strategy failed miserably, even under the direction of highly competent instructors. The students simply did not have the skills necessary for a successful interaction with environmental problems. (Hungerford and Litherland 1973a, p. TM-1).

Together they developed a set of skill-oriented, structured modules "to provide those skills so that students of varying abilities can become truly autonomous learners" and to prepare "middle school students to investigate environmental problems in an autonomous manner" (Hungerford & Litherland, 1973a, p. TM-1). The modules comprising this set were:

Module I: Looking into Environmental Problems;
Module II: Using Secondary Sources in Studying Environmental Problems;
Module III: Using Surveys, Questionnaires, and Opinionnaires in Environmental Science;
Module IV: Interpreting Data in Environmental Science.

According to Hungerford and Litherland (1973a, p. TM-1) "They set the scene for research and make provisions for research-no more."

> The first four modules are highly structured - purposefully structured in an attempt to produce a successful learning hierarchy. The fifth module, however, changes the rules completely ... Module V is both a self-paced and individualized learning experience (Hungerford and Litherland 1973a, Preface).

In short, "Module V: Studying an Environmental Problem: It's Your Move," was designed to support students in the type of autonomous research or investigation for which Modules I - IV had been preparing them. Thus, from the earliest days of this program, its developers saw the need for structured skill development as a prerequisite to autonomous skill application. Further, Hungerford and Litherland also ...

> ... hoped that this research [autonomous student investigations of local environmental problems] will set the scene for environmental action on the part of students. If it does, the modules will have been eminently successful - beyond the primary intent of the authors (1973a, p. TM-1).

However, there was little, if any, provision for this in the 1973 and 1975 editions of this curriculum. Clear and careful attention to this did not appear until the 1978 edition. From the outset, the developers also saw the need for program evaluation, and began using evaluation as a tool to both improve this program and articulate its strengths (i.e., validate it).

> During the 1972-73 school year, Modules I, II, III, and V were used with 130 students at Lincoln Junior High in Carbondale, Illinois. Results of that testing have prompted minor revisions of the original materials. Of even greater significance is the observation that interaction with Modules I, II, and III did, in fact, produce a cognitive climate favorable to autonomous research ... many of the students engaged in training and research did, in fact, evaluate their own values toward numerous issues of environmental significance with subsequent revision of those values taking place (Hungerford and Litherland 1973a, p. TM-2).

In addition to well-designed materials and program evaluation, the developers recognized that a third factor would be critical to the success of this program: well-prepared teachers. "Like so many teaching strategies, the success of this modular design depends to a large extent on the teacher" (Hungerford & Litherland, 1973a, p. TM-2). It became apparent to the developers that the shift from the structure of Modules I - IV to the individualized pace of Module V could be problematic for teachers: "The teacher MUST be prepared for this or his/her psyche will be ... traumatized by the shock of going from a highly structured situation into a highly unstructured one" (Hungerford & Litherland, 1973a, Preface). They also realized that some teachers would lack

the willingness and/or ability to shift from one teaching style and classroom environment to the other. While it would be some years before the developers and their colleagues would evolve a teacher education program and network, the need for it was apparent from the outset.

Overview of The Issue and Action Instruction Program

The primary focus of this program and associated curricula is on the development and application of investigation and evaluation skills to environmental problems and issues, and to alternative solutions and action strategies. As has been described elsewhere (Bardwell, Monroe and Tudor 1994; Ramsey 1998), these materials take a structured approach to the development of these skills, and then encourage the teacher to become a guide and facilitator during skill application. Traditionally, teachers who work with this program approach skill application in the form a project (i.e., for individuals, cooperative groups, or whole classes), and refer to this project as an "issue investigation." These projects require students to sequence and apply the skills they have been developing as they investigate community-based problems and issues. Ideally, these investigation projects lead into and culminate in action plans and projects that target the problems and issues investigated by students. For the most part, this program has been unique in maintaining its primary focus on skill learning, while allowing and encouraging students to engage in content learning on a "just-in-time" basis (i.e., substantial content learning occurs during the aforementioned projects). More will be said about the importance of skill learning in the section of this paper on the "Purposes of This Issue and Action Instruction Program."

As with many outdoor, conservation and environmental education programs (e.g., Hooked on Fishing; Project Learning Tree; Project WILD; Project WET), this program also has evolved a significant teacher preparation component and network of certified trainers. However, there are several important differences between the teacher preparation component for this program and those commonly used elsewhere (e.g., six hour or one day workshops). These differences pertain to the purpose(s), nature, length, and costs of the workshops, as related to (or determined by) the nature of the program and curricula. These differences also will be described in greater detail in the section of this paper entitled "Teacher Preparation for Issue Instruction."

There is an additional way in which this issue and action instruction program is different than most other outdoor, conservation, and environmental education programs (see Disinger 1981; Chenery and Hammerman 1984; Rakow and Lehtonen 1988; Simmons 1991). By the late 1980s and early 1990s, Hungerford and his colleagues had evolved a substantial research and classroom evaluation base to support claims about this program's effectiveness and worth with respect to stewardship behavior. The former will be summarized in the section of the paper entitled "Research Base for This Program," while the latter will be summarized in the section of the paper entitled "Classroom Evaluation Base for This Program." The evolving program theory that links these two elements is reflected in Figures 2 and 3.

Purposes of This Issue and Action Instruction Program

While all issue and action instruction curricula associated with this program feature the same skill development and application sequence, the educational purposes (i.e., mission, aims, goals, and objectives) they serve are broader than that. As suggested by the logic model in Figure 1, to understand this program and these curricula, it is necessary to understand these "Purposes." The broadest statement of purpose will be referred to as a mission statement. Typically, a program's mission statement is a broad philosophical statement about what it hopes to contribute to without any tying that to any particular age or grade level (i.e., as in goals), or any set of activities (i.e., as in objectives). Hungerford, Peyton, and Wilke (1980b) adapted the following super-ordinate goal statement from Harvey's dissertation (1976) to serve as their mission statement:

> The Superordinate goal ... to aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment (p. 43).

This statement appears in numerous articles prepared by the developers to describe the purposes of this program (Hungerford and Volk 1984, 1990; Ramsey, Hungerford and Volk 1992). It clearly reflects the role of citizens in resource stewardship and, as such, provides guidance for what the aims, goals, and objectives to be derived from it should address.

The aforementioned articles also articulate the educational goals of this issue and action instruction program. These four goals were drawn directly from Goals for Curriculum Development in Environmental Education (Hungerford, Peyton, and Wilke 1980b) that, in turn, were validated against the Tbilisi objectives (Unesco 1978). These four goals (or goal levels) are:

> Level I. Ecological Foundations: This level seeks to provide the receiver [learner] with sufficient ecological foundations knowledge to permit him/her to eventually make ecologically sound decisions with respect to environmental issues.
>
> Level II. Conceptual Awareness Level - Issues and Values: This level seeks to guide the development of a conceptual awareness of how individual and collective actions may influence the relationship between quality of life and the quality of the environment and, also, how these actions result in environmental issues which must be resolved through investigation, evaluation, values clarification, decision making, and finally, citizen action.
>
> Level III. Investigation and Evaluation Level: This level provides for the development of the knowledge and skills necessary to permit receivers [learners] to investigate environmental issues and evaluate alternative solutions for remediating those issues. Similarly, values are clarified with respect to those issues and alternative solutions.
>
> Level IV. Environmental Action Skill Level - Training and Application: This level seeks to guide the development of those skills necessary for receivers to take positive environmental action for the purpose of achieving and/or maintaining a dynamic equilibrium between quality of life and the quality of the environment (Hungerford, Peyton, and Wilke 1980b, pp. 43-44).

Of these four goal levels, Levels II, III and IV receive substantial attention in all issue and action instruction curricula. In Investigating and Evaluating Environmental Issues and Actions (IEEIA), Level I is not addressed due to the impracticality of providing scientific background on the wide range of environmental problems and issues it introduces. Rather, as was done by Ramsey during his years as a middle level science teacher, teachers using IEEIA are encouraged to teach a unit on ecology beforehand. In some other issue and action instruction curricula, Level I has been expanded beyond "Ecological Foundations" to include the other relevant "Scientific Foundations" that pertain the theme of that curriculum. This will be further clarified in the next section of this paper.

As is common to many, but not all, educational programs and curricular materials, all of the issue and action instruction curricula associated with this program contain instructional objectives. Typically, developers have prepared instructional objectives for each chapter and are found on the first or second page of each chapter in these curricular materials. These objectives were developed and presented to support instructional planning and delivery, as well as assessment (i.e., on a pre-assessment, formative, and/or post-assessment basis). Readers interested in learning more about these instructional objectives are encouraged to review these curricula. The above mission statement, and their associated goals and objectives have guided the development, implementation, and evaluation of all curricular materials associated with this issue and action instruction program.

The only aspect of "Purpose" not addressed above is the educational aims of this program. Aims can be viewed as characteristics to be developed or acquired over a lifetime (i.e., beyond the years of K-12 schooling). In the EE literature, when reference is made to characteristics of an environmentally literate citizen or citizenry, those characteristics can and should be viewed as aims of EE. The goals and objectives of EE programs such as this one should help learners develop or acquire these characteristics (i.e., meet these aims). The mission statement (superordinate goal) noted above introduces several of these aims: knowledgeable, skilled, dedicated, and willing to work. These aims are commonly found in environmental literacy frameworks constructed by the developers (Hungerford and Tomera 1985; Hungerford and Volk 1990) and by others in the field of EE (Simmons 1995; Wilke 1995).

Modern models of environmental literacy have evolved over much of the same time period, as did IEEIA. In part, this was due to the fact that some of the research and evaluation studies associated with this issue and action instruction program helped to shape those models of environmental literacy (e.g., Ramsey 1979, 1989, 1993; Klingler 1980; Hines 1985; Sia 1985; Sivek 1989). Nonetheless, while the components of this evolving model of environmental literacy (aims) were not available to guide the early development of IEEIA, they have guided assessments done as part of classroom evaluation studies, and guided both later revisions of IEEIA and the development of more recent issue and action instruction curricula (see Hungerford, Litherland, Peyton, Ramsey, and Volk 1988, 1990, 1992, 1996; Ramsey, Hungerford, and Volk 1989; Marcinkowski et al. 2000). From the perspective of the general logic model (Figure 1), this is precisely how the developers have built their program-specific logic model: by refining program "Purposes" and "Tools" so that they would be more clearly reflected in program "Outcomes" and "Impacts." Given this, it is appropriate to list here the characteristics of an environmentally literate citizen

viewed as aims of this program (Hungerford, Litherland, Peyton, Ramsey, and Volk 1996, p. 205):

- Environmental sensitivity (i.e., feelings of comfort in and empathy toward natural areas);
- Knowledge of ecological concepts;
- Knowledge of problems and issues;
- Skill in identifying, analyzing, investigating, and evaluating problems and solutions;
- Beliefs and values (i.e., beliefs are what individuals hold to be true, and values are what they hold to be important regarding problems/issues and alternative solutions/action strategies);
- Knowledge of action strategies;
- Skill in using action strategies; and
- Internal Locus of Control (i.e., the belief and/or feeling that working alone or with others, an individual can influence or bring about desired outcomes through her/his actions).

Issue and Action Curricula

According to the general logic model presented in Figure 1, the issue and action curricula to be described below all serve as part of the "Tool Box." What are these tools, and how have they evolved since the 1973 trial edition?

Investigating and Evaluating Environmental Issues and Actions: Skill Development Modules

The previously described trial education was the first in a series of editions of the modules designed to promote development and application of environmental problem-solving skills. In 1973, the developers prepared a revised edition based on the results of the field test (Hungerford & Litherland 1973b). These modules were revised again two years later, in this case with the substantial addition of artwork by then current graduate students (Hungerford and Litherland 1975).

It was not until the later 1970s that these modules saw the first of several expansions. With the assistance of Dr. Audrey Tomera, and insights gleaned from the dissertation work of R. Ben Peyton (1972) in the area of environmental action, the developers expanded these materials to include a new module, "Module VI: Environmental Action Strategies" (Hungerford, Litherland, Peyton, and Tomera 1978). In line with previously mentioned action-oriented aims and goals, the purpose of this module was to provide students with an opportunity to develop conceptual knowledge of and skill with responsible environmental action strategies. Consequently, Module VI addressed four major components of their "Paradigm for Citizen Responsibility": (a) whether specific human actions were positive, negative, or passive with respect the natural environment; (b) five categories of environmental action; (c) different levels at which actions could be taken; and (e) thirteen questions, referred to as action analysis criteria, for evaluating the appropriateness of actions proposed or planned by students (Hungerford and Peyton 1980). At the end of Module VI, students were required to prepare and evaluate plans for an action based upon the findings and recommendations from their investigation, but were not required to carry out that action:

> Your assignment here is NOT to take action, because this is something YOU would have to do AS A CITIZEN. Whether you take action will depend on your values and whether your work in these modules has persuaded that you should become involved ... The final decision is yours to make (Hungerford et al. 1978, p. 166).

The addition of Module VI went a long way toward realizing the hopes offered by Hungerford and Litherland (1973b) noted earlier.

The next edition of the Modules was completed in 1985. By then, the field of EE had experienced a surge of growth and development, all of which influenced this program. Developments during this period included publication of the reports of major conference sponsored by Unesco (Unesco 1977, 1978), completion of dissertations that helped define the field (Harvey 1976; Hart 1980), curriculum goals for EE that drew from and expanded on these sources (Hungerford, Peyton and Wilke 1980b), the first publications of the Research Commission that North American Association for Environmental Education (NAAEE) established in 1980 (Iozzi 1981, 1984), early models of environmental literacy (Hungerford and Peyton 1976; Hungerford and Tomera 1977, 1985) and, finally, seminal dissertation studies on correlates and predictors of responsible environmental behavior (Hines 1985, Sia 1985).

During this same period, Hungerford and Tomera served as major advisors for a series of Masters theses and research projects that served as the first experimental-type evaluation studies of this issue and action instruction program (Ramsey 1979, Klingler 1980, Volk 1980, Childers 1981). Of these authors, Ramsey and Volk went on to make significant contributions to the 1985 edition of this curriculum based on their work in these studies, their classroom experiences with this curriculum, and their involvement in developing other cur-

riculum components (e.g., issue analysis procedures; see Volk 1980, Ramsey, Hungerford and Volk 1989).

With the completion of the 1985 edition, now entitled *Investigating and Evaluating Environmental Issues and Actions* (IEEIA; Hungerford, Litherland, Peyton, Ramsey, Tomera and Volk 1985), this issue and action instruction program was coming of age. This curriculum reflected key aims and goals for the field of EE, and was supported by both positive findings from classroom evaluation studies and a growing body of research pertaining to environmental literacy and behavior. With a sound curriculum and program, questions were raised about how the skill development and application sequence that served as the core of this curriculum and program could be made available to a wider range of students. Two responses to this question were offered in the later 1980s.

Permutations of IEEIA

The first response reflected the developers' involvement in the science education community. In particular, Ramsey pushed for a Science-Technology-Society (STS) application (Hungerford, Volk and Ramsey 1990). The developers did this to address the growth of STS in the 1980s within the science education community, and interest within the STS community in environmental problems and in skill development and application with respect to STS problems (Rubba and Weisenmayer 1988, Coleman 1989, Simpson, McLaughlin, Volk and Hungerford 1989, Ramsey 1993). This STS format generally resembles IEEIA, with the following modifications:

- A new Chapter 1 was added to provide students with sufficient background on the nature of science, technology, and society, and on interactions amongst them;
- The range of problems used in skill development activities was expanded beyond environmental ones to include a wider range of STS problems (e.g., health and biomedical problems, technology-oriented problems such as agriculture and transportation);
- In Chapter 7, the main focus of the chapter was expanded to the solution of STS problems and resolution of STS issues.

As mentioned earlier, a second response was undertaken to allow the skills in IEEIA to be developed and applied by students in lower grades, particularly grades 5-6. In this case, a number of the developers and their colleagues helped prepare what they referred to as the "Extended Case Study" format (e.g., Culen, Simpson, Hungerford, Ramsey and Volk 1988, Ramsey, Hungerford and Volk 1989). This intermediate-level extended case study format has several important features, including:

- It consists of four or five chapters, each of which addresses one goal level from Goals for Curriculum Development in Environmental Education (Hungerford, Peyton and Wilke 1980b);
- The range of science and environmental content is narrowed to focus on a particular theme of national significance such as solid waste (Ramsey, Hungerford and Volk 1989, 1996), wetlands (Culen 1992), or threatened and endangered animals (Hagengruber and Hungerford 1993; Hungerford, Hagengruber, and Bluhm 1999);
- The skill development sequence is somewhat limited in comparison to IEEIA, allowing more space for the treatment of science and environmental content pertinent to the curriculum's theme; and
- Skill application is commonly undertaken in the context of the curriculum's particular theme, and in the form of whole class or large group investigations (Ramsey and Hungerford 1989).

As was true with IEEIA, several classroom-based evaluation studies of the extended case study format were carried out by developers for their dissertation studies (Simpson 1991, Culen 1996). And, as might be expected in light of positive results, extended case study materials have been both distributed and used in teacher in-service workshops since 1990 so as to provide trained teachers with a wider range of curriculum infusion options.

Lastly, a new experimental version of the extended case study was developed to address new opportunities and pressures in the public school that arose in the 1990s (Marcinkowski, Anderson, Drag, English, Lunsford, & Sward, 2000). This version of the extended case study format is designed for higher rather than lower grade levels (i.e., secondary level and higher). Altered features of this secondary-level extended case study format include:

- The use of a particular geographic region as its focus and theme (i.e., the Greater Everglades Watershed);
- This theme allows the chapter on science/ecological foundations to focus on the natural history and ecology of this region;
- This theme allows for a wider range of region-specific problems to be addressed than is typically found in intermediate-level extended case studies;
- While keeping the more detailed skill development sequence of IEEIA intact, more theme-related subject matter has been added to provide students with a stronger content background (i.e., in light of the

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complexity of problems and restoration efforts within this watershed) and to provide greater coverage of national and state standards that now drive school curricula;
- Because both subject matter and skills vary from chapter-to-chapter, a sample issue investigation was added as a model.

Much work remains to determine if this secondary-level extended case study format will be as effective as its predecessors.

Teacher Preparation for Issue and Action Instruction

The preparation of teachers to effectively use curricula is a central concern of virtually all EE programs. Materials have been prepared to support these efforts (Wilke, Peyton, and Hungerford 1987; Hungerford, Volk, Dixon, Marcinkowski and Sia 1988; Marcinkowski, Volk and Hungerford 1990; Simmons 2000). Due to its importance, a separate component that includes teacher preparation and other forms of teacher support, "Support for Tool Use," appears in the general logic model (Figure 1). One may apply the general logic model to teacher preparation programs just as I am applying it here to a K-12 program. In this case, the "Purpose" and "Outcome" of teacher preparation would be their understanding of and ability to effectively use issue and action curricula, and the "Tools" are those curricula. The target audience consists of practicing teachers in grades 6-12 and higher, and other interested education personnel. There are several "Delivery Systems" and "Delivery Strategies" for this type of teacher preparation, as will be described below.

Crucial Delivery Strategies for Teacher Preparation

As with most ARE and EE programs, teacher preparation programs for issue and action instruction have evolved over time. Due to the nature of the skill development and application sequence inherent in all issue and action curricula, the preparation of teachers to effectively use these curricula is substantially different than for many other nationally-available ARE and EE programs. The following have become common features of virtually all efforts to prepare teachers to effectively use the issue and action curricula described earlier (see Figure 2 and Figure 3).

First, teacher preparation programs must be longer in duration. This is, at least in part, due to the fact that few teachers have learned these skills, much less how to apply them or even teach them, during their pre-service training (Peyton 1978, Peyton and Hungerford 1980, McKeown-Ice 1995). For many years, the average length of teacher in-service workshops in this program was two weeks (i.e., 10-12 days). When funding was made available from larger grant sources (e.g., NSF, U.S. Department of Education's National Diffusion Network), summer workshops lasted as long as 3-4 weeks. Over the last few years, in response to concerns about length, Hungerford, program developers, and other certified trainers have designed and run workshops lasting one week.

Second, because the focus of this program was on skill development and application, and the general use of these materials requires a rather lengthy instructional sequence, the nature of this teacher preparation was different (i.e., it could not and did not rely on the use of a set of largely unrelated activities). From the outset, Hungerford and his colleagues took the position that all teacher preparation programs should model both the skill development and the skill application process. The former helps to familiarize teachers with the skills, the curricular material, and teaching methods appropriate for the teaching/learning of skills. The latter requires that teachers, usually in small groups, become familiar with skill application, the project sequence, and methods for facilitating these projects. By the end of each teacher workshop, all teacher-participants are familiar with these skills and have reported out their own issue investigation project.

Third, due to difficulties teachers often encounter in infusing or inserting an issue and action curriculum into her/his school program, in implementing (teaching from) that curriculum, and in appropriately guiding projects and assessing student learning, support for these teachers is almost always needed after in-services have been completed. This can take several forms: (a) encouragement to teachers to use Teachers Guides that accompany all issue and action curricula; (b) technical support through the workshop providers and/or material developers (e.g., CISDE); and (c) follow-up visits to teachers in their classrooms. Because no one of these was sufficient unto itself, the developers have relied upon a combination of all of these, particularly when time and funding permitted.

Fourth, due to the duration of these workshops and the need for follow-up, they tend to be more costly to run. Usually two or even three certified trainers oversee each workshop, raising salary and travel support costs. Teacher-participants are usually provided with housing and meals for the duration of the workshop, as well as travel support to get to and from the workshop site. Follow-up visits often require additional funding for staff time and travel costs. Nonetheless, Hungerford and his colleagues would argue that cost should not be the primary determinant of workshop length or follow-up (i.e., as may be argued from an output or cost/benefit perspec-

tive), because the benefits to teachers and, through them, to their students, exceed those possible in shorter workshops and without such follow-up. Given this, grant programs have become likely sources for this kind and level of support.

Viable Delivery Systems for Teacher Preparation

Because the above features are critical conditions to prepare teachers to effectively use issue and action curricula, there were three viable options to prepare teachers to effectively use them. First, in the 1970s, Hungerford and Tomera taught this skill development and application sequence in the form of a graduate-level EE course. Virtually all of the individuals cited in this paper as additional curriculum developers, authors of research studies, and authors of classroom-evaluation studies received their initial training in this manner. Many of these former Southern Illinois University graduate students have gone on to teach in other universities and to offer graduate-level issue and action instruction courses of this kind.

A second option was to offer issue and action instruction training in the form of an undergraduate course for pre-service teachers. It is noteworthy that such an issue and action methods course has been offered as a required science methods course at Southern Illinois University since 1989. Unfortunately, this appears to be the only university in the U.S. in which an issue and action course is included in a pre-service teacher education program as either a required or an elective course (McKeown-Ice 1995; T. Volk, personal communication, March 9, 2001).

Due to above-mentioned limitations in pre-service teacher education programs, the third option for preparing teachers is the most widely used in the field of EE: teacher in-service workshops. Since the early 1980s, the developers have obtained funding through State Eisenhower Funds and other sources to run in-service regional workshops in Illinois and other midwestern states. Once the 1985 edition of IEEIA was completed, efforts to obtain grants through federal agencies for these in-service trainings were particularly successful. Between 1985 and 1994, the developers obtained no less than seven grants through the National Science Foundation, allowing in-service workshops to be provided for teachers from Midwestern, Mid-Atlantic, and Southern states. These grants supported lengthy trainings and periodic follow-up efforts, and required substantial assessment and evaluation efforts. Data from these grant programs, coupled with data from classroom evaluation studies, were sufficient to permit IEEIA to be adopted onto the U.S. Department of Education's National Diffusion Network (NDN) in 1990, and the STS version to be adopted a year later. Through NDN, the developers garnered several years of support for material dissemination and teacher in-service workshops. Lastly, as a result of the growing credibility of this issue and action instruction program, several of the developers were approached by Kraft Foods to prepare a solid waste curriculum (Hungerford, Volk and Ramsey 1992, 1993) and to provide in-service training to selected teachers.

Collectively, the in-service workshops funded by private sources, and state and federal agencies allowed the developers to build a national network of 33 nationally certified IEEIA trainers and a larger cadre of district-level trainers in at least 13 states. On a national scale, trainers in this network are responsible for almost all of the program-related teacher preparation associated with the above three options.

Research Base for This Issue and Action Program

The research base for a particular program is important with respect to the general logic model even though there is no separate element for it (Figure 1). This is because research provides empirical evidence about the relationships between two or more of the model's elements. As noted earlier, the relationship of "Impacts" to other features of a logic model is of central importance, and therefore will be given primary attention in this section. As professionals associated with a particular program accumulate research evidence regarding the relationships between "Impacts" and other model elements, they may use that evidence to evolve a program theory for that program.

The theory and research base for any education program may draw upon research carried out by professionals related to that program, as well as upon the literature in related fields. This has been true for this issue and action instruction program. Its developers have relied upon their own studies (Hungerford, 1988; Hungerford, Volk and Ramsey 2000), research in EE (Iozzi 1981, 1984), and research in other fields (Hines 1985) as they evolved and refined their program. It is highly significant that, over the past two decades, the developers and their colleagues have come to recognize that the "program theory" that underpins and drives a good bit of ARE and EE practice is not supported by this research.

The Knowledge-Attitude-Behavior Model

The most popular program theory operating in EE and, quite possibly ARE, is known as the knowledge-attitude-behavior (KAB) model. The kinds of behavior (B) of interest here are the wide range of stewardship behaviors that are collectively known as Responsible Environmental Behavior (REB). Unfortunately, the

growing body of research about REB both within and outside the field of EE clearly demonstrates that this is an overly simplistic model: the K-A-B relationships are neither direct nor linear, and there are more variables and phases involved in the process of forming or shaping REB. As a result, this model has been critiqued by Peyton (1981), Sia (1985), Hines (1985), Marcinkowski (1989), Hungerford and Volk (1990), and Simmons (1991).

What kinds of theoretical assumptions are reflected in the KAB model? Hungerford and Volk (1990, p. 9) quote Ramsey and Rickson (1976, p. 10) as indicating that "increased knowledge leads to favorable attitudes ... which in turn lead to action promoting better environmental quality" (emphases added). Marcinkowski (1989, p. 95) offered a similar quote from Birch and Schwaab (1983, p. 30) to further illustrate the logic of this model:

> As previous research indicates ... the assumption must be made that informed attitudes will lead to subsequent water conservation behavior ... Further research should attempt to offer empirical evidence that knowledge and attitude gains resulting from the water conservation unit will influence a student's behavior regarding efficient water use" (emphases added).

Finally, in analyzing the goals of 1,225 nature and environmental centers, Simmons (1991) reported that about two-thirds of the responding centers identified goals which reflected knowledge-behavior and/or K-A-B models. These anecdotes provide some insight into the nature and pervasiveness of K-A-B thinking in the field.

Iozzi (1981, 1984), Hines (1985), and others have reported that attitude is by far the most commonly studied variable in EE, a circumstance which both reflect the pervasiveness of thinking about the role of attitudes (i.e., within the K-A-B model). They have also provided the research evidence to assess and critique this role. With respect to the knowledge-attitude (K-A) portion of the K-A-B model, Peyton (1981) presented a review of 21 studies that investigated these relationships. His review, and Marcinkowski's subsequent research review (1989, pp. 94-97), revealed a more complex relationship between knowledge and attitude than is implied in the K-A-B model. Research evidence indicates that: (a) the strength of the K-A relationship is contingent upon the particular dimension(s) of knowledge and attitude of interest; and (b) even when these are well matched, this relationship may be non-linear and can change over time. Similarly, reviews of research on the attitude-behavior (A-B) relationship (Sia 1985, pp. 66-67; Marcinkowski 1989, pp. 97-101) indicated that: (a) as with K-A, the strength of the A-B relationship is contingent upon the dimension(s) of both attitude and behavior; (b) the strength of this relationship also appears to be contingent upon or an artifact of measurement conditions; and (c) while attitude is one of several variables influencing behavior, there appear to be other variables which may moderate or influence the attitude-behavior relationship.

Evidence to support critiques of the K-A-B model can be found in other bodies of research, including Fishbein and Ajzen's work (1975, 1977) and research in the "diffusion-adoption" tradition (Rogers, 1995). Rogers reported that "KAP studies are sample surveys of knowledge (K), attitudes (A), and adoption of the practice (P) of family planning innovations ... [M]ost national family planning programs have found it much easier to diffuse knowledge about contraceptive methods (K) and to achieve favorable attitudes toward family planning (A), than to secure the widespread adoption and practice of contraception (P) by the target audience. Thus, KAP surveys often find a 'KAP-gap' with a relatively high percentage of knowledge and favorable attitudes toward family planning methods ... but a relatively low rate of adoption ... Knowledge gain and attitude change can be achieved more easily than can adoption of family planning methods" (1995, pp. 70-71; emphases added). Reviews of the research literature within and outside the field have clearly indicated the K-A-B model was a faulty and inadequate program theory to guide EE practice. If REB is to given more than lip service, a more adequate knowledge base had to be constructed through research to inform and guide practice.

Evolving Research Base for This Issue and Action Program

Over the past two decades, the developers of this program have made a concerted effort to summarize and synthesize research that has a bearing on this program (Hines and Hungerford 1984, Hines 1985, Hungerford 1988, Hungerford and Volk 1990, Volk and McBeth 1997, Marcinkowski 1998, Hungerford, Volk and Ramsey 2000).

Of these research documents, three made noteworthy contributions to the research base and program theory underlying this program. The first of these is the dissertation study by Hines (Hines 1985; Hines, Hungerford and Tomera 1986/87). While this was not the first attempt to summarize or synthesize the research on variables related to REB (see Lipsey 1977; Cook and Berrenberg 1981; Hines and Hungerford 1984), it is the most recent and remains the only quantitative synthesis or meta-analysis of research in the area of REB and in the field of EE. Following traditional meta-analysis procedures, she reviewed studies on REB from a variety of

fields and used statistical procedures to determine the strength of relationship between REB and associated variables. The core of her findings is presented in Table 1.

These findings provided evidence that knowledge and attitude were not as strongly correlated to REB as implied in the KAB model, and identified at least three other variables missing from that model: verbal commitment (or willingness, intention), locus of control, and personal responsibility.

Table 1. Summary of Hines' Meta-Analysis Results for Descriptive Studies

Variable	Corrected correlation coefficient	Corrected standard deviation	Number of values based on
Verbal commitment	.491	.130	6
Locus of control	.365	.121	4
Attitude	.347	.224	51
Personal responsibility	.328	.121	6
Knowledge	.299	.195	17
Education level	.185	.122	11
Income	.162	.084	10
Economic Orientation	.160	.118	6
Age	-.151	.200	10
Gender	.075	.084	4

Note: Several studies reported data on more than one variable.

During the same time that Hines was carrying out her study, a fellow graduate student was carrying out a different kind of investigation of variables related to REB. Sia (1985; Sia, Hungerford and Tomera, 1985/86) had begun to explore predictors of REB, drawing on Hines' work, the results of prior prediction studies and a working model of environmental literacy prepared by the developers (Hungerford and Tomera 1977; 1985). Several things about his study and results are noteworthy. First, he was one of the first to investigate more than one or two predictor variables; i.e., he investigated eight. Second, of these eight, six were significantly correlated to REB ($r = -.39$ to $.56$; $p<.05$): (1) environmental sensitivity; (2 and 3) knowledge of and skill in using environmental action strategies; (4 and 5) individual and group locus of control; and (6) psychological gender role (Sia et al. 1985/86, p. 37). Two of these variables lie at the heart of this issue and action program (i.e., 2 and 3), while two others were identified by Hines and are also positively influenced by this program (i.e., 4 and 5). Third, the results of his final stepwise regression analysis (Table 2) indicated that skill in using action strategies, environmental sensitivity, and knowledge of action strategies accounted for the majority of the variance (or variability) in REB scores (i.e., 49.24% of 51.25%).

Table 2 – Results of Sia's Stepwise Regression Analyses for the Total Sample (n=171)

Predictor Variables	R-Square Values	% Explained Variance	F	P
Perceived skill in using env. action (df = 1, 169)	.3454	34.54%	89.16	.0001
Level of env. sensitivity (df = 2, 168)	.1292	47.46%	41.31	.0001
Perceived knowl. of env. action (df = 3, 167)	.0178	49.24%	5.87	.0165
Belief in/attitude toward technology (df = 4, 166)	.0097	50.21%	3.24	.0737
Psychological sex role classification (df = 7, 163)	.0093	51.14%	3.14	.0784
Belief in/attitude toward pollution (df = 8, 162)	.0057	51.71%	1.92	.1673
Perceived indiv. locus of control (df = 9, 161)	.0036	52.07%	1.25	.2649
Perceived group locus of control (df = 10, 160)	.0008	52.15%	0.24	.6261

Sia's study was replicated by Sivek (1989; Sivek and Hungerford 1989/90), and replicated and extended by Marcinkowski (1989). Both studies corroborated the importance of Sia's top three variables as predictors of REB. Of particular relevance to this issue and action instruction program are the results from all three studies

Table 3. Summary of Stepwise Regression Results Regarding the Relative Ordering and Contribution to Explained Variance in REB for Knowledge of Action and Skill in Using Action

Study	Samples	Know. of Action Entry Order	Know. of Action R-square Value	Skill in Action Entry Order	Skill in Action R-square Value
Sia	Total	3rd	1.8%	1st	4.5%
(1985)	Sierra Club	3rd	1.1%	1st	30.1%
Sivek	Total	6th	.03%	1st	18.6%
(1989)	WI Trapper's Assoc.	7th	.02%	1st	28.1%
	Ducks Unlimited	5th	1.21%	1st	15.4%
	Trout Unlimited	4th	2.12%	1st	11.1%
Marcinkowski (1989)	Total	1st	19.3%	4th	5.3%

pertaining to knowledge of and skill in using action strategies. These results were summarized by Marcinkowski (1998, p. 249), and are presented in Table 3. In all three studies, and for all samples (separate and combined), one of these two variables served as the strongest predictor of REB. This either/or finding reflects the fact that the relationship between these two variables for Sia's sample (1985), Sivek's (1989) samples and subsamples, and Marcinkowski's (1989) sample were statistically significant in all cases (i.e., ranging from a low of r=.72 for Sivek's Trout Unlimited sample, to a high of r=.87 for Sivek's Wisconsin Trapper's Association sample).

Lierman (1995) carried out one of the few studies of predictors of REB using a sample of high school students. Her data (n=436) had been collected during the pilot test of the Secondary School Environmental Literacy Instrument (SSELI; Marcinkowski and Rehrig 1995, Wilke 1995). The SSELI included comparable measures for Sia's top five predictor variables and for REB. From Lierman's stepwise regression analysis of the full range of measured variables, she found skill in using environmental action strategies to be the strongest predictor of REB for these students, followed by willingness to act (as in Hines 1985) and issue identification skills (as in Volk 1980). These results provide evidence that there is an important link between variables found to serve as correlates and predictors of REB and the variables that are featured as aims of this program.

Hungerford and Volk (1990) conducted the third of the aforementioned research reviews as they prepared an invited paper. In this case, Hungerford and Volk did not collect their own data or rely on their own statistical analyses. Rather, they relied on prior reviews of research on REB. From their careful analysis of this literature, they generated a model of variables that were related to behavior (Table 4).

Table 4. Variables Included in Hungerford and Volk's (1990) Model

Stage	Major Variables	Minor Variables
A. Entry	Environmental sensitivity	Knowledge of ecology Androgyny (psychological gender role) Attitudes toward pollution, technology, and economics
B. Ownership	In-depth knowledge of issues Personal Investment in issues and environment	Knowledge of consequences of behavior (+ and -) Personal commitment to issue resolution
C. Empowerment	Knowledge of and skill in using action strategies Locus of Control Intention to act	In-depth knowledge of issues

For the purposes of this paper, three things are noteworthy about the variables included in Hungerford and Volk's model (Table 4):

1. The model contains all major variables identified in Hines' (1985) meta-analysis, as well as in prediction studies by Sia (1985), Sivek (1989), Marcinkowski (1989) and Lierman (1995). These appear to be stable and significant attributes of adults active in conservation and/or environmental pursuits and, to a lesser extent, of adolescents;

2. Most of these variables are found in modern environmental literacy frameworks (Simmons 1995, Wilke 1995), and therefore also serve as aims of EE ("Purposes" in Figure 1); and

3. Most of these variables are emphasized in this issue and action instruction program, and evaluation studies have found that they are influenced to a significant degree by this program.

The model summarized in Table 4 serves as the core of the program theory for this issue and action program, and represents a significant departure from the popular but ineffective KAB model. The extent to which these correlates and predictors of REB can be influenced by this issue and action instruction program will be summarized in the next section.

Evaluations of This Issue and Action Instruction Program

As presented in Figure 1 and as discussed earlier, "Outcomes" is a central element of any logic model. Michael Quinn Patton suggests that without evidence of program's outcomes, a program is often left to justify its worth using arguments based on intrinsic values (e.g., tradition, popularity, etc.). In this section, I will summarize the empirical basis for the "Outcomes" of this program, and their relationship to "Purposes," "Tools," and "Delivery Strategies."

Table 5 – A Summary of Results for Experimental-Type Evaluation Studies of This Program

			Results for Program Aims as Outcome Variables *									
Author, Date	Grades	Curric.	Env. Sens.	Know. Ecol.	Know. Issues	Skill/ Issues	Know. Action A	Know. Action P	Skill/ Action	Locus of Control In.	Locus of Control Gr.	REB
Ramsey, 1979	7th	IEEIA					X					X
Klingler, 1980	8th	IEEIA					X					X
Volk, 1980	8th	IEEIA			X							
Ramsey, 1989	7th	IEEIA	ns				X	X	X	X	X	X
Ramsey, 1993	8th	IEEIA	ns				X	X	X	ns	X	X
Holt, 1988	8th	IEEIA	ns				X	X	X	X	ns	X
Bluhm et al. 1995	6th	IEEIA						X	X			X
Bluhm & McBeth, 1996	6th	IEEIA						X	X			X
Withrow, 1988	5th/6th	Case St.			X		X	X	X	ns	ns	X
Simpson, 1991	5th/6th	Case St.					X		ns	ns	ns	X
Culen, 1996	7th/8th	Case St		X			X		X	X	ns	X
Jordan, 1986	Non-formal	-					X					X

* Notes:
Under Know. Action, A = Actual, and P = Perceived
Under Locus of Control, In. = Individual, and Gr. = Group
X = significant at $p < .05$; ns = not statistically significant; blank = not measured

There are several ways of collecting evidence about a program's outcomes. These include: (a) periodic assessment by teachers (e.g., using surveys); (b) periodic assessments of students (i.e., as in standardized testing); (c) evaluation studies using quantitative designs (e.g., experimental-type studies); and (d) evaluation studies using qualitative designs. The developers have used all four of these methods to determine the effects and effectiveness of this program's curricula and teacher preparation efforts.

Results from Experimental-Type Evaluation Studies

This issue and action instruction program is unique in the fields of ARE and EE in that program-related evaluations have been conducted on a regular basis since its first year, 1973, and that many of these evaluations have been experimental in nature. Since the late 1970s, at least 12 experimental-type evaluation studies have explored the effects and effectiveness of issue and action curricula in school classrooms and non-formal settings. Many of these have been reviewed in earlier research documents (Hines 1985; Hungerford 1988; Volk and McBeth 1997; Hungerford, Volk and Ramsey 2000).

The benefit of experimental-type studies such as these is that they can provide sufficient control over internal validity threats to permit cause-and-effect claims to be made with a reasonable degree of certainty or probability (Campbell and Stanley 1963). It is noteworthy that several of these have been replication-type studies to determine if results obtained in an earlier study were or were not due to this program. As stated earlier, the ability to support cause-and-effect claims is central to program impact theory and logic modeling, making experimental-type studies and replications of them particularly valuable.

Experimental-type Studies of IEEIA

These 12 experimental studies have been organized into three groups: classroom studies of IEEIA, classroom studies of extended case studies, and one study conducted for a non-formal program (Table 5). The largest number of quasi-experimental studies have looked at the effects of IEEIA, largely because this is by far the oldest and most widely used of available issue and action curricula. In the first of these studies, Ramsey (1979) compared IEEIA-based instruction with awareness-level case study instruction and with standard science instruction at the 7th grade level. He reported positive results on his two outcome variables, knowledge of action strategies and level of involvement in REB. In 1981, Ramsey oversaw a follow-up study of students who had been involved in his 1979 study. Graduate students were trained to conduct double-blind interviews of students from both treatment and control classes. He found that these graduate students were able to pick out every student from his treatment group on the basis of interview responses alone. Further, he found that students exposed to IEEIA continued to engage in higher levels of REB than did their control group peers despite the absence of any instructional reinforcement (i.e., with only social reinforcement from family, peers, and youth groups) (Ramsey 1981, Hungerford and Volk 1990).

Klingler's study (1980) was undertaken as a replication of Ramsey's earlier study (1979). He used the same material, similar methods, and the same outcome measures, but with 8th grade students. The consistency between his results and Ramsey's results lends credibility to Ramsey's original findings (Table 5).

Ramsey's later studies (Ramsey 1989, 1993; Ramsey and Hungerford 1989) involved seventh and eighth grade teachers who had completed an extended issue and action instruction in-service workshop, and who were implementing IEEIA in their own classrooms. These seventh and eighth grade classes were compared to other classes from those same schools that were exposed to standard science instruction. These studies may be seen as replications and extensions of the earlier studies and of each other, as well as evaluations of the efficacy of the previously described issue and action teacher preparation programs. In these studies, Ramsey drew upon prior research (Ramsey 1979, Peterson 1982, Sia 1985) in developing his outcome measures. In both studies, he used five measures: (a) a Likert-type measure of individual and group locus of control; (b) a phenomenological measure of subjects' overt REB; (c) a Likert-type measure of environmental sensitivity; (d) a phenomenological measure of students' knowledge of environmental action strategies; and (e) a Likert-type measure of perceived knowledge or and skill in using environmental action strategies. In both studies, analyses of data from pre-test measures of variables (a) and (b) indicated that there were no significant differences between treatment and control groups (Ramsey & Hungerford, 1989, p. 33; Ramsey, 1993, p. 34). Further, as reported in Table 5), Ramsey found in both studies that the classes exposed to issue and action instruction scored significantly higher on posttest measures of variables likely to be influenced by issue and action instruction than did the control classes (i.e., with the exception of Individual Locus of Control in the 1993 study). Finally, in both studies, Ramsey reported that treatment/control difference on post measures of environmental sensitivity were not significant. He inferred that while periodic outdoor experiences were prone to influence this variable, classroom-

based issue and action training was not (Ramsey and Hungerford 1989, p. 32; Ramsey 1993, p. 36).

Holt's study (1988) was conducted shortly after the data for Ramsey's 1989 and 1993 studies had been collected (i.e., 1987). Her students were exposed to the same material, similar teaching methods, and the same five outcomes measured used in Ramsey's 1989 and 1993 studies. However, her study is unique in that the students exposed to IEEIA were lower achieving students. Her results indicate that these issue and action curricula can work as well with non-gifted as with gifted students (Table 5).

Two additional quasi-experimental studies of the effects of IEEIA were undertaken in the mid-1990s. In the first (Bluhm, Hungerford, McBeth and Volk 1995), the developers and several colleagues sought to refine and validate their Middle School Environmental Literacy Instrument (MSELI), a more comprehensive measure of learning outcomes associated with environmental literacy. The second study was undertaken as part of this MSELI instrument development effort, and was included in a report on IEEIA to the U.S. Department of Education's National Diffusion Network (Bluhm and McBeth 1996). In both studies, 6th grades exposed to IEEIA (treatment group) were compared to 6th grades exposed to standard instruction (control group). Further both studies used a post-only design and found that the treatment classes outscored the control classes on all three outcome variables: (a) perceived knowledge of environmental action strategies; (b) skill in using environmental action strategies, and (c) self-reported involvement in REB (Hungerford, Volk and Ramsey 2000).

The remaining quasi-experimental study of the effects of IEEIA (Table 5) was conducted by Volk (1981; Volk, Hungerford and Tomera 1981). In it, Volk specifically investigated the effects of issue and action instruction on eighth-grade students' ability to identify and analyze issues. She reported that students exposed to IEEIA were able name more issues, identify more sides to named issues, and provide more rationales for differing sides than did her control sample ($p<.01$). This study provided the evidence to support the addition of the evolving approach to issue analysis to the 1985 edition of IEEIA (Ramsey, Hungerford and Volk 1989).

Experimental-type studies of intermediate-level extended case studies. Several of the studies describe above demonstrated that IEEIA had a more substantial and significant effect on knowledge, skills, and REB than did awareness-level case studies (Ramsey 1979; Childers 1981; Jordan, Hungerford and Tomera 1986). As described earlier, the developers of IEEIA prepared an extended case study version of their issue and action curriculum to overcome the apparent weaknesses of awareness-level case studies, as well as to provide a more appropriate way of providing issue and action instruction to students in intermediate grades. Three quasi-experimental studies were undertaken to determine if the intermediate-level extended case study format would lead to the same learning outcomes as were apparent in studies of IEEIA (Withrow 1988, Simpson 1991, Culen 1996).

In the first of these research studies, Withrow (1988) explored the effect of an unpublished extended case study of his own design (i.e., on deforestation in the Midwest) on fifth and sixth grades using a post-only quasi-experimental design. He reported that the class exposed to the extended case study scored significantly higher than did the class exposed to standard instruction (control class) on five of his seven outcome measures: (a) actual knowledge of environmental issues; (b and c) actual and perceived knowledge of environmental action strategies; (d) skill in using environmental action strategies, and (e) self-reported involvement in REB (Withrow 1988; Hungerford, Volk and Ramsey 2000). He did not find significant differences on his measure of (f and g) individual and group locus of control.

Simpson conducted a similar study involving 15 classrooms of fifth and sixth grades from Illinois and Tennessee. She used an extended case study on Canada geese that she had helped to develop (Culen, Simpson, Hungerford, Ramsey and Volk 1988), and collected data using a post-only control group quasi-experimental design. She measured the same outcome variables as Withrow except for (a) knowledge of issues. On her measured outcome variables, her results were similar to Withrow with one exception. She did not detect a significant difference between treatment (IEEIA) and control classes on (d) their skill in using action strategies (Table 5).

In the most recent of these studies, Culen (1996, Culen and Volk 2000) explored the effects of an extended case study that he had developed on wetlands (Culen 1992). His sample consisted of 15 intact classes of seventh and eighth graders from Illinois and Missouri. His design was similar to Ramsey's (1979) original study, comparing IEEIA-based instruction with awareness-level case study instruction and with standard science instruction (as a control). He used six outcome measures: (a) ecological foundations; (b) actual knowledge of environmental action strategies; (c) skill in using environmental action strategies; (d and e) individual and group locus of control; and (f) self-reported involvement in REB (Culen 1996; Culen and Volk, 2000; Hungerford, Volk and Ramsey 2000). He found significant differences on his three pre-test measures (i.e., a, d, and f),

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and therefore used analysis of covariance (ANCOVA) to carry out posttest comparisons. He found that his IEEIA-based group significantly outscored the control group on all but one of these variables (i.e., e above; $p<.05$). He also reported that his IEEIA-based group significantly outscored his awareness-level case study group on the posttest measure of behavior (i.e., f, above).

Experiment-type Studies in a Non-formal Setting

At the time Jordan began his study, only one other study appearing in The Journal of Environmental Education had investigated the effects of a non-formal program on REB (i.e. Asch and Shore 1975). Results from surveys of program during this period suggested that few non-formal programs undertook any form of outcome evaluation (Disinger 1981, Chenery and Hammerman 1984/85). Thus, the study undertaken by Jordan was, and remains today, unique in light of these conditions within the non-formal sector.

Working with six-day residential programs for high school students offered by an environmental center, he set up and compared an awareness-level workshop (i.e. focusing on natural history, ecology, environmental issues, and resource management) with issue and action workshops (i.e., focusing on environmental issues, resource management, and environmental action strategies) (Jordan, 1985; Jordan, Hungerford and Tomera 1985). Material for the latter workshop was derived, in part, from the action paradigm appearing in IEEIA, though did not include the skill development and application material found in earlier chapters of IEEIA. Participants in all workshops underwent both pre- and post-tests using the same two instruments used by Ramsey (1979) and Klingler (1980). His measures of REB were designed to cover the 2-month period prior to each workshop (i.e., administered during the pre-test) and the 2-month period after each workshop (i.e., administered as a delayed post-test).

Jordan (1985; Jordan, Hungerford and Tomera, 1986) reported that participants in the issue and action workshops demonstrated a significant pre-post gain in knowledge of action strategies ($p<.05$), as well as higher level of knowledge of action strategies on the posttest measure than did those in awareness-level workshops. The same results were reported for his measures of self-reported REB. Thus, with some modification and in the hands of trained instructors, non-formal programs can be designed and delivered to help learners more than awareness of problems/issues.

Measurement of Outcome Variables in Experimental-Type Studies

The instruments used in these studies to assess learning outcomes on a pre/post or post-test only basis evolved over time, as this program and its accompanying research and evaluation base evolved. The first instrument (Ramsey 1979; Klingler 1980; Ramsey, Hungerford and Tomera 1981; Jordan 1985) assessed only students' knowledge of environmental action and their level of REB. Even so, Ramsey remains one of the few to use other sources to corroborate self-reported REB data (i.e., to do so, he used a parental questionnaire on a blind basis). His 1979 instrument is shorter and simpler than the multi-sectioned instrument used in Ramsey's later studies (1989, 1993), and in studies by Holt (1988), Withrow (1988), Simpson (1991), and Culen (1996).

Efforts by Ramsey, prior researchers, and other developers helped to evolve and validate a multi-section instrument to assess environmental literacy and evaluate this program at the middle school level. This instrument came to be known as the Middle School Environmental Literacy Instrument (MSELI). By 1993, MSELI was in its fourth edition. Over 1994-95, MSELI received greater scrutiny as part of the "Environmental Education Literacy/Needs Assessment Project" (Bluhm, Hungerford, McBeth and Volk 1995). Following this project, MSELI was further refined and used to evaluate this program (e.g. Bluhm and McBeth 1996). The evolution of this instrument, along with supporting validity and reliability estimates, was chronicled by McBeth (1998). In these ways, the developers of this issue and action program attempted to insure that the instrument used to assess learning outcomes were valid and reliable, as well as consistent with the program's research base. In the language of the logic models presented earlier (Figure 2 and Figure 3), these efforts helped insure that "Participant Outcomes" could be attributed to the "Tool Box," and that these "Participant Outcomes" were conceptually and methodologically consistent with both "Program Purposes" and sought "Program Impacts."

Results from Periodic Assessment of Students

Prior to the widely distributed report, *Closing the Achievement Gap* (Lieberman and Hoody 1998), few efforts had been made to explore or evaluate the effects of EE programs in schools on subject area learning outcomes. Today, in the climate of national and state standards, increased calls for accountability, and increasing use of high-stakes assessments to determine the worth of school programs, few question the need for EE to explore or evaluate these effects. It is noteworthy that before Lieberman began his project and study, and before these trends became prominent in K-12 schooling in the

U.S., Hungerford and his colleagues oversaw at least two such studies. Readers should note that these two studies are substantially different than the previously described classroom evaluation studies in that the outcome variables are measured using standardized tests.

Both of these studies were initiated in 1992. In the first, Gavilla (1992) sought to compare issue and action instruction against more traditional environmental science instruction using the Iowa Test of Basic Skills (ITBS) commonly used in Kansas City area schools. Both classes received instruction over a semester, and were assessed using ITBS on a post-only basis. Gavilla's analysis of scores from the Science Achievement and the Social Studies Achievement Tests indicated that the class exposed to issue and action instruction scored significantly higher than did the class exposed to environmental science instruction ($p<.05$).

Hungerford and his colleagues at Southern Illinois University undertook the second study in 1992. They contacted and received standardized achievement test data from 28 teachers who had been trained in issue and action instruction. These teachers were from eight states (i.e., IA, IL, KY, MD, MO, TN, TX, WI), and taught in grade levels 5 - 12. They reported "ninety-six percent (96%) of the respondents indicated that the achievement of students experiencing this (issue and action) approach was greater than that of peers who had not experienced this training" (Hungerford, Volk and Ramsey, 2000, p. 8). Of these 28 teachers, only one indicated that achievement was only "the same or greater" when compared to standard subject area instruction. They go on to summarize these teachers' results as follows:

> When questioned about the areas of achievement, 86% reported greater achievement in science, 46% reported greater achievement in social studies, 54% reported greater achievement in language arts, and 75% reported greater achievement in library skills. Sixty-one percent (61%) of the respondents reported greater overall achievement on the part of students experiencing the issue investigation approach (2000, p. 8).

In light of the positive results from both studies, Hungerford, Volk, and Ramsey inferred "that the acquisition of those higher order skills (evident in issue and action curricula) permits students to function at a higher order of cognition when approaching the standardized tests of achievement" (2000, p. 7).

Results from Periodic Assessments by Teachers

To date, there have been few attempts to survey teachers about their classroom experiences with, or about the apparent effects of, issue and action instruction. The 1992 survey by Hungerford and his colleagues was presented in the previous section because teachers were reporting results from standardized achievement tests (i.e. as opposed to their own perceptions). Braun (1997) undertook the only other survey of teachers trained in issue and action instruction.

There were two purposes to Braun's study (1997). The first was to survey teachers who had completed at least one issue and action training workshop on a number of independent variables, and four dependent variables (i.e., perceptions of student achievement in four goal areas). The second purpose of this study was to determine the extent to which those independent variables helped explain variability (variance) in the dependent variables using multiple regression and correlation (MRC) statistical methods.

To gather these data, she developed a three-part measure: (Section 1) a measure of eight independent variables (e.g., teaching background, training in and use of issue and action curricula); (Section 2) a dependent measure consisting of 21 learning outcomes in four goal areas; and (Section 3) a measure of an independent variable, "outside influences on classroom implementation." Section 2 was based upon the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton and Wilke 1980b), prior research (Volk 1983), and material emphasized in issue and action curricula. Hungerford, Volk, and Ramsey reviewed a draft of this measure. The final version of it consisted of 21 learning outcomes measured using a five-point student achievement scale (i.e., 0=Not at all, 2=Moderate, 4=Complete).

Braun's sample consisted of 360 teachers from 11 states who had completed at least one issue and action instruction workshop, and whose names appeared in a database managed by faculty at Southern Illinois University as part of their National Diffusion Network (NDN) project. Of these, 99 teachers returned responses, although only 65 of these were usable (i.e., from teachers who had implemented issue and action curricula). With respect to her first purpose, these 65 teachers tended to teach science (n=48), teach in grades 7-8 (n=31), and had completed at least one graduate degree (n=37). On average, they completed two training workshops (mean=1.99), lasting more than two weeks (mean =2.3), and had implemented issue and action instruction for almost two years (mean = 1.97). The majority of these teachers reported using IEEIA or IESTSIS (n=39),

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while smaller numbers reported using extended case studies (n=11), or a combination of the two (n=13).

With respect to the dependent variables, teachers' perceptions of student achievement were highest for learning outcomes under Goal Level 2: Issue Awareness (mean =2.55). This followed by outcomes under Goal Level 3: Issue investigation/evaluation (mean =2.37) and under Goal Level 1: Ecological Foundations (mean =2.28). The latter can be partially explained by the fact that majority of teachers reported using IEEIA/IESTSIS, neither of which were designed to address Goal Level 1. The teachers' lowest perceptions of student achievement were for learning outcomes under Goal Level 4: Citizen action skills (mean =1.80, or below "Moderate"). It is noteworthy that these teacher perceptions pertain to achievement of learning outcomes related to action-related knowledge and skills. This may help to explain their apparent inconsistency with the positive results on REB, or action-related behavior, reported in all of the classroom evaluation studies (see Table 5). Two other plausible explanations for the apparent inconsistency between these ratings and prior results are (a) students may engage in a higher level of REB through exposure to this program as a whole, even when teachers and students do not address all elements of action training in these curricula, and (b) teachers' perceptions of student learning outcomes associated with Goal Level 4 may not adequately reflect students' out-of-school involvement in REB, and therefore may be limited.

The results of Braun's MRC analyses are interesting. She reported that the list of 11 "Outside Influences" was the only independent variable found to serve as a significant predictor of student achievement for each of the four goal levels ($p<.05$). Further analyses were not carried out to determine which of these eleven may be influence teachers' perceptions of student achievement at each goal level (e.g., administrative support, prior knowledge of ecology and environmental science, fit to their school's curriculum). Only two other independent variables were found to serve as significant first-order predictors of teachers' perceptions of student achievement: for Goal Level 1: Ecological foundations, the grade level at which they taught; and for Goal Level 2: Issue awareness, the subject area in which they taught. In light of teachers' perceptions and these results, Braun called for research of both a quantitative and qualitative nature.

Results from a Qualitative Evaluation Study

At least within the U.S., limited attention has been given to qualitative evaluation in the fields of ARE and EE. This is also true for this issue and action instruction program. For this program, the low level of attention to qualitative evaluation parallels the level of attention given to periodic assessments of students and to assessments by teachers (i.e., in comparison to the substantial attention that has been given to experimental-type classroom evaluation studies). There are mitigating reasons for this. From an historical perspective, many of the experimental-type evaluation studies of this program were carried out prior to the rise of qualitative methods in EE in the 1990s (Mrazek, 1993; see Table 5). Further, from a practical perspective, the amount of training, preparation, time, and effort required to carry out sound qualitative evaluation studies has often limited their use. Finally, from the developers' perspective and the perspective of logic modeling, experimental-type studies provide evidence regarding cause-and-effect claims, and therefore are of unique value to this program. Given these factors, it is noteworthy that Winther (1999) decided to carry out a qualitative evaluation of this issue and action program for his dissertation.

In this study, Winther (1999) explored teacher decision-making during the first year of implementation of IEEIA (i.e., following their completion of a summer training workshop). From the teachers who completed this workshop and who volunteered to participate in this study, he randomly selected eight teachers: three high school, two middle school, and three elementary teachers. Selected teachers were from different states (e.g., MD, MO, TX).

His final four questions focused on: (1) what motivated teachers to participate in the training for and to implement IEEIA; (2) teachers' perceptions of this training; (3) how teachers working with IEEIA perceive the support they receive from peers and administrators; and (4) the perceptions and reactions of teachers as they implement (or interact) with IEEIA. While this study was not designed to do so, these questions clearly explored variables or factors included in Braun's (1997) list of "Outside Influences" that were found to predict teachers' perceptions of student achievement in this program (e.g., prior knowledge of ecology and environmental science, fit of issue instruction to their curriculum, adequacy of preparation, support from administration).

To gather information and perceptions needed to respond to these research questions, he interviewed each teacher three times: at the close of the summer workshop prior to implementation, at midyear during implementation, and at the end of the spring term toward the end of implementation. Other sources used to verify these teachers' responses included visits to their schools, examination of teacher- and student-prepared materials, interviews with their students, informal discussions with peer teachers at their school, and implementation reports they submitted. Winther's qualitative methods reflect a

naturalistic approach, inductive process, design flexibility, and personal contact, as well as use prolonged engagement and triangulation to help establish the dependability and credibility of information and perceptions (Guba 1981, Patton 1990).

In response to the first two research questions above, Winther concluded that:

> Participants initially found the training difficult and confusing. As they continued training and implementation some participants found that the program was substantially different from what they were accustomed to doing in their classrooms. Some participants were reluctant to implement the program ... Others implemented the program fully, and were extremely enthusiastic about what their students were doing and learning (1999, Abstract).

With respect to the third research question noted above, Winther reported that support from administrators and peers was important, but not as important as previously thought.

> Administrators were perceived as supporting the program [IEEIA] because the program helped facilitate goals that had largely been established in the school. Peer support was social and largely passive. Participants perceived that neither administrators nor peers really understood how the program worked (1999, Abstract).

Winther concluded that teachers' perceptions of the training, the program, and support base stemmed from what he referred to as "cognitive changes" stimulated by the training and program. "Comments from all of the teachers reflected reactions to these changes. Some teachers resisted the changes, while others enjoyed the process" (1999, Abstract).

Winther's study confirms what the developers, trainers, and researchers associated with this program have learned through experience; i.e., some teachers are more "ready" than others to change the way in which they perceive the teaching and learning process, and their own roles in that process. To effectively use this issue and action program, teachers must be willing to change and grow. For this reason, Winther (1999) has recommended that factors associated with "teacher decision-making" (i.e., this change process), be explored in greater depth. From a practical perspective, research of that kind could help guide workshop advertising, recruitment, and selection processes. From the perspective of logic modeling, research of that kind could be used to insure that the "Delivery Approaches" for this program's "Tools" and methods to "Support Tool Use" were appropriate for its intended "Target Audiences."

Recommendations

For the 28 years over which this issue and action program has evolved, much has been learned that is relevant to the goals of Stewardship Education, be that in the field of ARE or EE. Its developers have learned much about designing and developing skill-based and project-driven curricula such as IEEIA and extended case studies, and about how to prepare teachers to effectively use these curricula. They have carried out research studies and supported the synthesis of research in an effort to use empirical findings to help guide the evolution of these curricula and their teacher preparation programs. They have also carried out various kinds of evaluations to determine how well these curricula and teacher preparation programs are working, and to further refine them. This systematic use of data, coupled with attention to what has worked in practice, has made this issue and action program sound, credible, and somewhat unique in ARE and EE. While this issue and action program is not as widely used across the U.S. as some other ARE or EE programs, the logic models that under-gird this program, as described in this paper, are substantial. For that reason, its key elements deserve careful scrutiny and consideration by any professionals who work in the area of Stewardship Education. On the basis of the accomplishments (to date) within this issue and action program, the following recommendations are offered to professionals working in the area of Stewardship Education.

Purposes

1. The organization's mission, overall educational aims, more specific education program goals, and instructional objectives should be aligned with one another so that they all clearly reflect the nature and purpose of Stewardship Education: To prepare learners to be actively involved in the stewardship of ecological and natural resources.

2. The organization's educational aims should reflect the best of what is known about what it takes for citizens to become actively and effectively involved in stewardship efforts on a sustained basis. In this paper, I have suggested that these aims are apparent in evolving, research-based models of environmental literacy (Simmons 1995, Wilke 1995, Volk and McBeth 1997).

3. The organization's educational goals and objectives should be structured and sequenced in such a way that they encompass and foster what is known about environmental literacy (aims).
   (a) These goals and objectives should not be limited to awareness, knowledge, and/or attitudes if stewardship is a desired outcome. These goals and objectives must also address the other affective dispositions (e.g., locus of control, assumption of personal responsibility), skills, and participation strategies that are more closely related to learner (and citizen) participation in stewardship.
   (b) Further, these goals and objectives should not focus solely upon the natural world, or even upon problems and issues if stewardship is a sought program impact. These goals and objectives must focus, at least in part, on the kinds of solutions and service/action projects that make stewardship a concrete reality. In this paper, I have indicated that the developers of this program have used and adapted the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton and Wilke 1980b) as their guide for program goals and objectives.

4. Program goals and objectives should be viewed as anticipated learning outcomes, and compared to a program's actual learning outcomes as determined through assessment and evaluation efforts. This involves linking Program "Purposes" to "Outcomes" and "Impacts" on an empirical basis.

Curricula

5. Curricula for stewardship education should be structured in such a way that learners will be provided with a well-thought-out sequence of opportunities to develop, build upon or practice, and eventually apply their awareness, knowledge, affective dispositions, skills, and participation strategies. To accomplish this, the developers of this program have relied on the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton, & Wilke, 1980b), as well as their knowledge of skill development and application methods, and methods for overseeing student projects.

6. Stewardship-oriented curricula that are project-driven should be structured so that learners are adequately prepared to undertake each step of that project. Further, they should be structured so that teachers can prepare learners for (as instructors) and guide learners through (as facilitators) the entire project process.

7. These opportunities for learners to develop, build upon or practice, and eventually apply their awareness, knowledge, affective dispositions, skills, and participation strategies should take into consideration the learners' developmental level(s), prior knowledge and experience, and aptitude (i.e., these opportunities should be challenging, but within their reach). To reflect these considerations, IEEIA was designed for use with middle level students, while many of the earlier extended case studies were designed for younger learners (see differences in "Delivery Strategies" in Figures 2 and 3).

8. Curricula should be periodically reviewed and, as appropriate revised to reflect recent feedback from teachers and learners, results of recent assessment and evaluation studies, results from recent research studies and syntheses, and other sources (e.g., national and state standards; parents). The earlier narrative on the evolution of IEEIA is a good example of how this has been done within this issue and action program.

Teacher Preparation

9. When preparing teachers to work with stewardship-oriented programs and curricula, adequate time must be provided for teachers to develop, build upon or practice, and eventually apply their own awareness, knowledge, affective dispositions, skills, and participation strategies. One-shot workshops will never be able to accomplish this. If prolonged in-service workshops such as those used with this issue and action program, are not available, other options should be considered (e.g., a series of workshops for the same teachers).

10. Teacher preparation programs should help teachers become intimately familiar with curricula and other resources they will be asked or expected to use in their own classrooms. This is why all graduate courses and in-service workshops for this program emphasize the use of program curricula.

11. When preparing teachers to use stewardship-oriented curricula that are project-driven, teachers must be provided with an opportunity to engage in such projects themselves, even if on a somewhat simplified basis. As has been the experience in this issue and action program, only when teachers engage in projects themselves do they become more fully aware of project requirements, components, procedures, difficulties, and associated evaluation and grading procedures.

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12. When preparing teachers to use stewardship-oriented curricula, several other features will often increase teachers' effective use of them, as has been apparent in this issue and action program:
    (a) Providing these teachers with adequate support as they plan and implement that curriculum. This should include instructional, resource, and assessment support;
    (b) Providing these teachers with opportunities to share with other trained teachers their questions and efforts related to curriculum planning, implementation, and assessment and evaluation; and
    (c) Providing these teachers with subsequent opportunities to refresh and expand upon what they got out of initial preparation opportunities (e.g., extended workshops).

Assessment and Evaluation

13. Evaluations of ARE and EE programs must move beyond the collection of program outputs (i.e., number counts and feedback; see Chenery AND Hammerman 1984/85) to include the assessment of learning outcomes and, whenever feasible, longer-term program impacts. In this issue and action program, assessment of learning outcomes has been viewed and undertaken in this manner since 1973, particularly in the previously described classroom evaluation studies. In some studies, program impacts have also been assessed (e.g., Ramsey 1981).

14. In many instances, the assessment of learning outcomes will be undertaken for evaluation purposes (e.g., in most classrooms). When appropriate, the assessment of learning outcomes should include pre-assessment (e.g., on prerequisites, instructional objectives), formative assessments, and summative assessment. In some instances, the assessment of learning outcomes may be undertaken for research purposes (e.g., in classroom studies for theses and dissertations). In these cases, the use of pre-testing (i.e., a form of or a substitute for pre-assessment) and post-testing (i.e., a form of or substitute for summative assessment) should also reflect appropriate research procedures and controls (e.g., as in Culen 1996).

15. As recommended under the Purposes Section above, learning outcomes to be assessed should not be limited to the main features of the KAB model (i.e., awareness, knowledge, and attitudes). Rather, efforts should be made to assess a broader range of learning outcomes associated with environmental literacy and stewardship (e.g., the other affective dispositions such as locus of control, assumption of personal responsibility, skills, participation strategies). Assessment instruments such as the MSELI used in this issue And action program (Bluhm, Hungerford, McBeth and Volk 1995; McBeth 1997), and the related SSELI (Marcinkowski and Rehrig 1995) offer some ideas as to how this can be done.

16. Regardless of whether the assessment of learning outcomes is undertaken using quantitative and/or qualitative methods, steps should be taken to insure that resulting assessment data are "trustworthy" (Guba 1981). In quantitative terms, this means that steps must be taken to insure that assessment instruments yield valid and reliable data. In qualitative terms, this means that other methods must used to insure that the resulting assessment data are credible and dependable (Guba 1981). In this issue and action program, substantial attention has been given to instrument validity and reliability (Bluhm, Hungerford, McBeth and Volk 1995; McBeth 1997), particularly when this has involved the collection of self-reported data (e.g., Ramsey 1979) and perception data (see Table 5 for studies measuring both actual and perceived knowledge of action strategies). Further, in Winther's (1999) qualitative evaluation study, clear attention was given to methods recommended by Guba (1981) and others to insure credibility and dependability.

17. The results of evaluation-oriented assessments of learning outcomes should be used by program staff as opportunities for the purposes of program learning (i.e., how this program is working) and program improvement (i.e., where a program's curricular, instructional, and/or assessment practices need to be improved). Once a program is well defined and established, as with this issue and action program, research-oriented assessment results may be used for other purposes, including program validation (Bluhm and McBeth 1996) and logic modeling, as has been done in this paper.

Research

18. One of the most influential decisions to be made in any stewardship education program is whether or not to design, develop, implement, and assess/evaluate that program in light of prior research. In ARE and EE, many programs still rely on the ineffective KAB model described earlier, an indication that inadequate attention is being paid to prior research. The evolving research base in EE, including the previously described research base for this issue and action program, provides strong cues as to what stewardship education programs should in-

clude and address. As a profession, we need to pay greater attention to what has been learned through research

19. Once the above decision has been made, it is also important that professional educators stay current with this evolving body of research and participate in its evolution. For many in the fields of ARE and EE, both of these activities will require some additional training to enable them to do so (e.g., in research methods, as critical consumers of research, as collaborators in research). The developers of this program and many of its trainers have been both beneficiaries of and provider of this through graduate-level research training.

20. From the perspective of logic modeling, many important research questions can and should be generated by asking about the relationships between/among a program's elements. A list of general questions drawn from logic modeling prepared by Rossi, et al. (1999), was presented earlier in the paper. If needed, that list and the general logic model (Figure 1) can serve as a starting point. Beyond that, in the fields of ARE and EE, one of the most fundamental questions to be asked and explored is this: "Are our goals and objectives, our tools, and our methods sufficient to help learners to attain learning outcomes that are critical to their effective participation in stewardship activities?". This question has been given substantial attention by Hungerford and his colleagues, as is reflected in the research and the evaluation efforts that are summarized herein.

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Outdoor and Risk Educational Practices

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Abstract – This paper examines the definition of outdoor adventure education, which is education occurring in the outdoors. It focuses on the curriculum, programs, and leadership issues as they effect change in knowledge, attitude, behavior, and skills. Parameters in the field are defined, such as the ethics of care, program design, and goals and objectives of a program. Additionally, evaluation areas, gaps in research and future research are addressed. Outdoor adventure education is a growing field that will continue to grow and develop in the future. Suggestions for practices in the field are identified specifically as they relate to what has worked in the past and what the future may hold. More people are participating in outdoor education each year and these numbers will continue to grow over time making quality outdoor adventure education increasingly important.

Definition, Venues, and Participants

Experiential Education

Experiential education is learning by doing or by participating in an experience. Through direct experiences with nature, people, objects, things, places, and by actually learning by doing, scientific evidence has shown that the learning process is faster, what is learned is retained longer, and there is greater appreciation and understanding for those things that are learned first hand (Freeberg and Taylor 1963). The intent of experiential education is to create a just and compassionate world by transforming education and promoting positive social change (Association of Experiential Education Handbook 1995). Social change occurs when people learn and gain understanding, awareness, and appreciation of others.

Experiential education involves any combination of senses (i.e., touch, smell, hearing, sight, taste), emotions (i.e., pleasure, excitement, anxiety, fear, hurt, empathy, attachment), physical condition (e.g., temperature, strength, energy level), and cognition (e.g., constructing knowledge, establishing beliefs, solving problems) (Carver 1996). Experiential education can occur in both controlled environments, such as an outdoor backpacking trip or a ropes course, as well as the uncontrolled situations, such as learning how to do things on one's own. When learning occurs for an individual from an experience, insights are gained into themselves and their environment.

Outdoor / Adventure Education

Outdoor education is a form of experiential education that is important in society today. A large portion of society participates in some form of outdoor education, such as fishing, hiking, camping, or boating. According to Ford (1981), outdoor education is education in, about, and for the outdoors, implying a place, a topic, and a reason. The three components are the location outdoor education will occur, a subject matter to discuss, and a purpose behind the discussion. Another working definition states that outdoor education is "an experiential method of learning which takes place primarily through sensory involvement with the out-of-doors" (Priest and Gass, 1997, p. 17).

Horwood (1999) suggests there are five characteristics of adventure that serve as criteria to determine if an activity is adventurous. These characteristics include uncertain outcomes, risk, inescapable consequences, energetic action, and willingness to participate. Adventure education has become the widely accepted name for activities that employ risk and challenge, in a variety of settings, to attain a variety of educational goals (Hirsh 1999). Risk recreation education, adventure education, and outdoor education throughout this paper will be used interchangeably and will refer to education that is done in the outdoors and involves adventure.

Hammerman (1994) examined seven basic needs served by outdoor education. These included:

- Effective learning, realism in education.
- Environmental literacy.
- Re-creative experiences.
- Basic skills.
- Awareness.
- Environmental respect.

People learn effectively through active learning and in experiential education they are often empowered to form their own groups and given responsibility for

the management of that group (Lindsay and Ewert 1999). This empowerment to work in groups and learn at the groups or individuals own pace facilitates learning by students.

Many students have a need for education to have realism. By undertaking activities, the individual can comprehend the importance of each component and therefore enhance retention and facilitate integration into everyday life. Outdoor education is taught in a practical manner in order for people to better understand and relate to the ideas and concepts presented.

There is a strong need for environmental literacy that is served by outdoor education. Outdoor education provides information about the outdoors, which includes information on a variety of environmental subjects. By learning about the environment, people become aware, become positive role models, and become better stewards of natural resources. In the broadest sense, environmental education encompasses teaching about the quality and quantity of all aspects of the environment (Ford 1981). It is a process where the individual develops understanding and appreciation of the natural environment and then recognizes this understanding. It is also an interdisciplinary process that examines the total environment and hopes to maintain and enhance the quality of life through the quality of the environment. Environmental education is concerned primarily with both ecosystemic (interdependence of living organisms in an ecological system) and ekistic (interaction between human society and the natural resources in the environment) relationships (Priest and Gass 1997).

Outdoor education provides a means for participants to experience a re-creative (recreational) experience. In general, people have a strong desire to participate in recreation and to be active. Another need served by outdoor education is the need for basic skills. This includes the desire to stay warm when outdoors, be able to take care of oneself in a primitive area, and to eat and drink when hungry or thirsty. Other basic needs may include starting a fire, creating shelter, or finding food.

Awareness of the outdoors is part of outdoor education. In outdoor education, the emphasis for a subject of learning is placed on relationships among people and natural resources (Priest and Gass 1997). In the outdoors, people become aware of their role and relationship with nature, as well as becoming aware of their own strengths and limitations. Being in the outdoors provides an individual with a setting in which to experience self-discovery.

Outdoor education today is one component of the larger environmental educational field. Ford (1981) believes that it may be the largest component of environmental education and it may affect the greatest number of people through recreational interests. By having this effect on a large number of people, respect for the environment is developed. Outdoor recreation includes those experiences that offer a meaningful relationship between the participant and the out-of-doors (Russell 1986). If people are using the outdoors for an activity, such as fishing, kayaking, biking, or hiking, they are doing so within the context of the surrounding natural environment. By learning about the natural environment, they hopefully will develop a deeper respect and appreciation.

Venues

Outdoor education occurs in a diversity of venues, ranging from wilderness explorations to artificial climbing walls and ropes courses. These and many other venues often are operated through private and public organizations, non-profit organizations and commercial businesses, churches, schools and colleges, and social clubs and organizations. Some of the leading organizations that run trips and wilderness explorations include the National Outdoor Leadership School (NOLS), Outward Bound, Wilderness Education Association (WEA), and universities.

Wilderness trips occur in settings humans do not control. Travelers in such settings do not have control of elements of nature, such as the climate (weather) or environmental factors (falling trees or natural fires). Qualifications of a wilderness area include the size of the area, as well as the human experience in that location. It is a physical and conceptual place, which is relative rather than an absolute conception and condition (Miles 1999). The wilderness provides an environment for challenge, growth, and development of both individuals and groups. The wilderness is used by millions of people every year for individual growth and challenge, group dynamics, and therapeutic intentions. Over 700 organizations offer wilderness programs for personal growth, according to Friese (1996) and these programs are increasing in numbers by about 15 percent per year (Gager 1996).

Artificial climbing walls have become very popular for introducing individuals into the sport of rock climbing (Attarian 1999). According to Rock and Ice Magazine, seventy percent of indoor climbers that were surveyed had never climbed outdoors (Soles 1993). Artificial climbing walls provide a controlled environment for experiencing rock climbing. Climbing walls originated in the 1500s for training soldiers (Thomas

1988) and have increased in popularity during the past 50 years (Attarian 1999). Climbing walls provide a number of opportunities for individuals and groups. They provide year-round programming, climbing in any area of the world (urban or rural, low or high elevations), programs for all age groups and skill level, a safe, controlled environment, a place to increase skill level, reduction of social and environmental impacts of climbing, increased number of participants, and they can be used for team-building or therapeutic interventions. Climbing walls can be used for recreational uses, instruction, training or fitness, and competitions (Attarian 1999).

Attarian (1990) defined ropes courses as a series of obstacles of elements suspended by steel cables, ropes, and specialized hardware, usually from large trees or utility poles. Ropes courses, also known as challenge courses, are a series of activities and initiatives that encourage group participation, leadership, trust, teamwork, communication, and problem solving. High ropes course elements are based on individual outcomes. The low elements require the entire group to work together to complete tasks. Challenge courses have become increasingly popular across a wide range of settings in the United States and many other countries (Rogers 2000).

The success of a ropes course program depends on a delicate blend of skills and character: a taste for challenge, tenacity in problem solving, and the ability to work with others (Outward Bound Brochure 1995). Ropes courses encourage groups to work together when completing tasks and activities, often called initiatives. Schirich (1996) believes that ropes courses are a multidimensional teaching tool. Some goals for ropes course participants may be communication, teamwork, leadership, trust, and having fun. A ropes course can be used as a metaphor which can illustrate a groups strengthens and weaknesses as they work together. All learning is done using experiential education. For learning to occur, the facilitator processes the activity with the group. Processing and then being able to apply what the group has learned during the activity is called transference.

Adventure Education Curricula

Wilderness Curriculum

The parameters that equate to the "best professional practices" affect change in knowledge, skills, attitudes, and behaviors. Scientific literature, educational research, and peer recommendations support these parameters. Most areas of adventure education have a curriculum associated with either the organization or the specific program. By examining the curriculum, we can generate an overall list of adventure education curriculum needs.

Outdoor adventure education programs have potential to be used to improve moral development of participants (Garvey 1999b). Moral development can be part of the overall curriculum associated with participant experiences. Reimer et al. (1990) address 10 activities that could be used in creating outdoor adventure education experiences that address moral development:

- Developing a rationale for moral development.
- Identifying moral uses that may arise in the program.
- Helping relate or transfer the inherent moral issues in an outdoor adventure program to the participants' lives.
- Selecting activities that promote participants taking the role of "another".
- Modeling and facilitating the acquisition of higher order moral reasoning skills.
- Creating opportunities for participants to address their personal moral dilemmas.
- Working with a colleague as co-facilitator.
- Pilot testing the intended activities.
- Allowing students to act on their own reasoning.
- Committing to continued staff renewal and development.

There are several larger outdoor education associations that are viewed as the leaders in the field of adventure education. These are the organizations that started the outdoor education movement and remain leaders in the field. Outward Bound, preeminent in the North American outdoor education movement, is recognized as a major industry contributor to standards in safety, program design, and leadership (Hirsch 1999). Outward bound was founded on quality and safety, dedicated to true adventure, and making a difference in people's lives. It was created on the four pillars of physical fitness, self-reliance, craftsmanship, and compassion. The following are educational objectives and course requirements for Outward Bound programs.

Educational Objectives:

- Personal development
- Interpersonal effectiveness
- Environmental awareness
- Learning
- Philosophy and values

Course Elements:

- Natural environment: provides the arena in which our students are free to examine new roles, to gain control of their lives through self-sufficiency and face the direct consequences of their actions.
- Relevant skills training: enables out students to function with competence and safety in the natural environment.
- Stress/hardship: exposes students to a series of increasingly difficult challenges that compel them to examine their own reactions and responses in new situations requiring decision and action.
- Problem solving: requires the individual and/or group to analyze situations and arrive at solutions.
- Service: develops a sense of responsibility for the welfare of others and stewardship of the environment.
- Reflection: encourages and allows students to consider the experience, through structured debriefs, informal discussions and Solo, in ways that promote insight and self-discovery.
- Evaluation: encourages constructive examination and assessment of individual students, and promotes a positive response in the form of action.
- Measurement of course objectives: encourages self-evaluation as students measure and internalize the results of their effort relative to their expectations; Instructors must help frame expectations and perspectives, provide clarity and objectivity to conclusions drawn, and identify overlooked issues.

The National Outdoor Leadership School (NOLS 1986) core curriculum suggests the comprehensive nature of the learning experience include: minimum-impact camping and resource protection, travel techniques, outdoor living skills, safety, environmental awareness, and expedition dynamics. The curriculum was expanded by NOLS in 1998 to include:

Safety and Judgment

- Basic first aid.
- Safety and accident prevention.
- Hazard evaluation.
- Wilderness medicine-related injury prevention and treatment.
- Rescue techniques.
- Emergency procedures.

Leadership and Teamwork:

- Competence.
- Self-awareness.
- Expedition behavior.
- Judgment and decision-making.
- Tolerance for hard work.
- Communication.
- Vision and action.
- Small group expeditions.
- Practical leadership opportunities daily.

Outdoor Skills:

- Campsite selection.
- Shelter and stove use.
- Fire building.
- Sanitation and waste disposal.
- Cooking, baking, nutrition and rations.
- Equipment care and selection.
- Keeping warm and dry.
- Route finding and navigation.
- Activity skill development -- backpacking, kayaking, horse packing, sailing, fishing, telemark skiing, caving, climbing, canoeing.

Environmental Studies:

- Leave-no-trace camping and resource protection.
- Ecosystems.
- Flora and fauna identification.
- Geology, weather, astronomy, land management and cultural issues.
- Public service.
- Wilderness ethics.

The purpose of the Wilderness Education Association is to create a curriculum for use in an educational setting to train future outdoor leaders. Once again, this organization seems to contribute to both the curriculum, programming, and leadership needs of the adventure education field. The Wilderness Education Association's 18-point curriculum elements (Teeters and Lupton 1999) include:

- Decision-making and problem solving.
- Leadership.
- Expedition behavior and group dynamics.
- Environmental ethics.
- Basic camping skills.
- Nutrition and ration planning.
- Equipment and clothing selection and use.
- Weather.
- Health and sanitation.
- Travel techniques.
- Navigation.
- Safety and risk management.
- Wilderness emergency procedures and treatment.
- Natural and cultural history.
- Specialized travel and adventure activity.
- Group processing and communication skills.
- Trip planning.
- Teaching and transference.

Outward Bound, NOLS, and WEA have set the examples for outdoor adventure education companies through their leadership, programming, and curriculum. Their standards have effected changes in behaviors, knowledge, skills, and attitudes throughout the field. They have been leaders in research and education. NOLS has founded the "leave-no-trace" ethic, which has been widely accepted by outdoor educators.

Ropes Course Curriculum

Challenge courses have their own set of criteria for programming, leadership, and curriculum. Project Adventure (PA) was founded in 1971 with a goal to mainstream the Outward Bound curriculum into the secondary public schools. By 1980 over 400 schools across the country had adopted at least one component (academic or physical education) of the original PA program (Hirsch 1999). The company's goals are to help be a catalyst for personal and professional change and growth of organizations and individuals. According to Hirsh (1999), the key elements of an adventure curriculum for Project Adventure include:

- A sense of adventure.
- Unpredictability, drama, and suspense.
- A consistently high (but accomplishable) level of expectation demanded and created by both the intrinsic and external forces.
- A success orientation in which growth is supported and encouraged and in which the positive is emphasized.
- An atmosphere of mutual support in which cooperation, encouragement, and interpersonal concerns are consistently present.
- A sense of enjoyment, fun, and the opportunity to laugh at a situation, each other, and oneself.
- An approach to learning which makes use of group problem solving, which allows for a variety of personal contributions and which presents problems that can't ordinarily be solved individually.
- The use of a learning laboratory that is more complex, more engaging, less predictable and less familiar than a classroom.
- The merging of intellectual, social, physical and emotional learning and development.
- A significant amount of cognitive work related directly to abstractions and questions previously developed or subsequently to be developed.
- The combining of moments of active involvement with moments of personal and group reflection and evaluation.
- A definite organization and structure which define the limits of the experience and state expectations, but within which the participants have freedom to make decisions, choices, and even mistakes.
- An economic and structural reasonableness that allows the curriculum to effectively compete for dollars and other resources within an educational economy that is limited in its resources.

Project Adventure is a pioneer in the use of the debriefing technique (Hirsch 1999). The process of reflecting, processing, debriefing, and transference of knowledge gained through participation has been part of most developmental adventure education experiences. Through facilitation, it has been shown that participants gain knowledge and understanding through processing their experience. Other essential features of developmental adventure programming include: developmental goals, deliberate and sequential process, use of risk and challenge, group context, and the experiential cycle (Hirsh 1999).

Leadership

The development of hard and soft skills is needed by leaders to effectively teach participants in adventure education. Soft skills involve facilitation, instructional, and organizational skills. Hard skills include technical, safety, and environmental skills. According to Priest and Gass (1997), there are also meta-skills that hold the soft and hard skills together. Effective communication, flexible leadership style, professional ethics, problem solving, decision-making, and experience-based judgment are some of the meta-skills needed.

Several outdoor leadership researchers (e.g., Cousineua 1977, Swiderski 1981, Buell 1983) have specifically examined the competencies necessary for an outdoor leader. According to Hattie et al. (1997), most adventure programs impact leadership competencies. Others (e.g., Shiner 1970, Mendence 1979, Simmons 1982, Priest 1988) have made recommendations for training outdoor educators in higher education. According to Raiola and Sugerman (1999) there are nine elements that have emerged as preferred curriculum content for outdoor leadership education. These nine elements include:

- Leadership style.
- Objective and subjective judgment.
- Trip planning and organization.
- Environmental issues.
- Risk management.
- Instructional principles.
- Navigation.
- Group dynamics.
- Nutrition.

During the past several years outdoor leadership curriculum has increased in use through universities and colleges. The title and the department that houses the programs have varied widely as has the curriculum. Raiola and Sugerman (1999) suggested using the nine elements listed above for teaching outdoor leaders, but recognized that selection of the elements to focus on and the sequence of the elements were also dependent on each educators' curriculum.

Adventure education has also been used in the classroom setting. It is through the process of facilitation that the experience can be linked to a number of different disciplines. Adventure education has been used to enhance the learning of college students (Beidler 1980, 1985, 1987). Placing the students in environments where they work together on problem solving, trust, leadership, and communication can strengthen the learning process.

Parameters of Adventure Education

Adventure education contains elements of uncertainty, real or perceived risk, excitement, interaction with nature, and effort (Bunting 1990, Ewert 1989, Priest 1990, Raiola and O'Keefe 1999). Risk activities can provide opportunities for the development of a positive self concept by helping participants discover their capabilities, individual limits, and what they can do (Meier et al. 1980). Rohnke (1986) suggests that risk provides that spice that makes achievement satisfying. Knowing that adventure education has several advantages, it is also important to recognize the parameters that help define the field. Some parameters include:

- Ethics of care.
- Program design.
- Program implementation.

Ethical issues are intimately bound up with every aspect of adventure education, and that ethics must be dealt with by adventure education (Hunt and Wurdinger 1999). Ethics of care issues deal with safety of both people and of the environment. Working with individuals, professionals have an ethic to care for them both physically and mentally in an adventure education setting. Challenge by choice is a practice that outdoor educators use when working with individuals. Challenge by choice means that it is each individuals choice on how far they can challenge themselves and if they do not feel comfortable they do not have to participate in a specific activity. Ethically it is important to provide individuals with the option on how far they can go during an activity. Participants need to feel comfortable both physically and mentally when working with a group. It is important to set up guidelines with a group prior to starting an activity, so everyone understands the importance of being physically and mentally safe.

One of the most important themes in outdoor adventure education is that the participants should be provided with the necessary skills, both mental and physical, to enable them to experience success in using and preserving the outdoors (Cinnamon and Raiola 1991). The emphasis is not on winning or losing, but rather on facing the challenges of the activity. Some of the generally accepted goals are personal growth, skill development, excitement and stimulation, challenge, group participation and cooperation and understanding of one's relationship to the natural environment.

Ethics of care also deal with the environment. When working with a group, minimum impact practices should be taught and understood by all members of the group. By using the environment, students learn that it is important to respect it and to take care of it for future generations. It is also important to role model positive behavior towards the environment. The leader in an outdoor setting needs to provide the group with direction and guidance in their actions. A leader can teach minimum impact skills in a positive and encouraging way.

Designing a program for all populations is another important parameter of adventure education. Programs should be accessible to people with all types of disabilities, from all cultures, ethnicities, economic backgrounds, and gender. The mission of Wilderness Inquiry, a wilderness adventure company based out of Minneapolis, Minnesota, is to encourage inclusion of people with all ability levels. Being accessible to all populations might involve additional training and equipment needs, but as an adventure education program, there is an obligation to meet these needs.

Another important parameter is program implementation. The goals and objectives of a program must match the practices of the program that is being implemented. Through carefully articulated mission statements, goals and objectives, detailed manuals, leadership training, and appropriate marketing materials, organizations can ensure that leaders effectively meet customer needs during their experience.

Evaluation Methods

Adventure program evaluation presents several challenges to researchers. Evaluation traditionally has not been a priority relative to program development

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and service (Warner 1999). This has changed over the past 30 years with an increase in evaluation studies. During the past decade, these studies have devoted more attention to understanding the process and components of program effectiveness rather than simply focusing on outcomes (Warner 1999). Still, a wide variety of programs do not conduct evaluations for use as learning tools.

By conducting evaluations on a regular basis, an organization can gain knowledge from their programs that can be used formatively to make changes. If a program only conducts evaluations at the end of an event, they often miss pieces of information that can help shape the direction of the program. This information is useful to identify needed changes and to prevent mistakes from recurring.

Accreditation, a form of a peer review, is a type of evaluation. The Association for Experiential Education (AEE) and the Association for Challenge Course Technology (ACCT) have set outdoor industry standards that are recognized nationally. AEE has a peer review process and in 1984 the safety committee published *Common Peer Practices in Adventure Education.* It brought the association together in a united effort to determine those techniques and practices that could be mutually agreed upon as contributing to the safety of adventure programming. This publication is perhaps the best compilation of safety standards in adventure programming available (Garvey 1999a). ACCT offers standards for both building ropes courses and facilitating on them. Some of the operation standards set by ACCT include risk management, belaying, spotting, staff qualifications, and environmental impacts. ACCT's purpose is to promote the use of Challenge Courses and to set minimum standards (Challenge Course Standards Manual 1998).

The very same environmental factors that make a wilderness trip exciting, unique, and challenging also make research difficult (Ewert and McAvoy 2000). These challenges include:

- Carrying and protecting data collection material from the natural elements.
- Not intruding on the group dynamics of a small group.
- Practicing minimum impact camping while trying to collect data.
- Finding time and energy to collect data.
- Allowing the participants to experience the range of emotions that can occur in a wilderness setting without interfering on their personal space.

Other research challenges may include a small sample size, logistics, scheduling, and the goals of the program itself. Further, it is often difficult to sort out why change is occurring for the participants. Some participants come on wilderness trips to change, called the "readiness to change syndrome" (Borstelman 1977), and therefore the actual program may not be a catalyst in changing the individual.

Psychological and structural obstacles are faced when creating evaluations. The first psychological obstacle is the need for the leader to change if necessary. The second issue which blocks practitioners from getting more involved in evaluation and research effort is the tendency of researchers to use jargon and sophisticated technical procedures which obscure the nature of the evaluation process (Warner 1999). Structural obstacles in the field of experiential education include the lack of time of practitioners. There are typically few incentives and payoffs to conduct program evaluations from an organizational perspective (Warner 1999). With effort from the organizations and practitioners, these obstacles can be overcome. It takes time, resources, and energy to make evaluation effective, but it is possible.

Gaps in Literature

Early evaluation research primarily studied individual changes in the wilderness and other outdoor settings, whereas now it is incorporating group dynamics issues. Examination of group development in organized wilderness group programs is just beginning and will probably continue to develop as a major research theme (Ewert and McAvoy 2000). The methods used to collect data are becoming more diverse and creative. They are looking at the how and why of programming, versus only looking at the what and when of the program. Ewert (1987) encourages the researcher to look beyond the outcomes generated from an outdoor adventure activity and to provide an understanding as to why it happened and how it can be made to happen again.

Evolving research themes and methods of research included an early focus on the individual but is now moving towards the influence that the experience has on the group. There is an influence of experience on group variables, such a group development, cohesion, trust, social relations, and family function (McAvoy 2000). "Despite the importance and popularity of the issues associated with group dynamics, there have been relatively few systematic studies done under the rubric of organized groups in wilderness settings" (Ewert and McAvoy, 2000, p. 17). Studies have shown that on a short-term basis in good conditions, groups do function

well in the wilderness context. When conditions become stressful, demanding or too long, group dynamics can deteriorate (Ewert and Heywood 1991, Wood et al. 1999, Leon et al. 1994).

Hattie et al. (1997) examined the effects of adventure programs on a diverse array of outcomes such as self-concept, locus of control, and leadership. They used a meta-analysis to synthesize the findings across several types of programs. Their analysis showed that the effects of adventure programs on self-esteem exceed those of any other type of educational program. Further, they suggested future research needs to move towards evaluating multiple outcomes and investigating the relationships among program characteristics and outcomes. They also recommended:

- Using dependable measurements.
- Using a sample size large enough to obtain a power of at least .80.
- Using tests that are related to the desired outcomes.
- Including scales unrelated to expected outcomes to act as a type of control.
- Providing clear documentation and analyses relating to appropriate background variables.
- Ascertaining the effects of the instructor.
- Investigating interaction effects between the major variable.
- Making sure the nature of the program is documented.
- Consider alternative designs.

There is a need to move from outcomes to theory and process studies. Hattie et al. (1997) discuss four premises on the positive effect that adventure education has on participants, and states that these premises could be the basis for future research. The four premises include, quality of experience, obtaining designed goals, amount and quality of feedback, and examining the individual's coping strategies. A further area of investigation that could inform research and offer insights on the interactions between environmental and personal aspects of adventure programs relates to the literature of expeditions, particularly in extreme environmental conditions such as in the Antarctic and at high altitude (Hattie et al. 1997).

A few researchers (Bialeschki and Henderson 1992, Jones and Hollenhorst 1998, and Walker et al. 1998) examined the flow model with adventure education. All of these studies have been quantitative in nature and have used the Experience Sampling Form (ESF) to gather data. Jones and Hollenhorst (1998) studied the optimal adventure within an on-site whitewater kayaking setting using a modification of the Experience Sampling Method (ESM). Walker et al. (1998) also used a questionnaire to collect data regarding participant flow experiences. The study illustrated that optimal experiences do appear to occur during outdoor recreation events. Future studies using the flow model could be conducted with qualitative designs, as well as looking at a diversity of outdoors areas and activities.

Several researchers have examined ropes courses and looked at various populations as they participate in experiences. These studies have used both quantitative and qualitative approaches. Theories behind some of the studies were unclear or not stated, while others drew from diverse fields of study as one would expect from an interdisciplinary field like experiential education (Carver 1996). Teamwork and group development issues are the ropes course outcomes that have been examined at great depth in the past. Other researchers have probed the relationships among trust, self-esteem, communication, and risk-taking.

Goldenberg (1997) used means-end analysis to examine ropes course outcomes. Her research examined the links between the benefits derived from participating in a ropes course and the higher-level outcomes and personal values important to a particular individual. According to Goldenberg et. al. (2000), additional research should be conducted to better understand these benefits and determine their role and generalizability in other ropes course and adventure education settings. Means-end analysis could be extended to different types of groups, as well as to different types of adventure education programs.

Different types of groups that use wilderness settings have been studied in the past, but there are currently several gaps in the literature that need attention. Research (McAvoy et al. 1995, Robb and Ewert 1987) has shown the benefits of the wilderness experience for people with disabilities in both integrated and segregated groups. A disability group that has received little attention in wilderness group research is people with developmental disabilities (Ewert and McAvoy 2000). The challenges of self-reporting for this group have made research difficult to conduct.

A few researchers have documented the potential and actual benefits of an all-women wilderness group (Asher et al. 1994, Mitten 1994, Powch 1994). However, according to Ewert and McAvoy (2000), most of these studies have been qualitative, so it is difficult to generalize findings to other groups. They also noted that there is little information on how wilderness actually contributes to the benefits and outcomes of these programs for these groups.

Wilderness therapeutic groups are part of adventure therapy that takes small groups into the wilderness settings. However, little is known about the effects of adventure therapy. Some work has focused on "at-risk youth" and has been primarily reported in dissertations that have had methodological limitations (Ewert and McAvoy 2000). There is also very little research on family therapy in wilderness settings.

Future Research

More inquiry is sorely needed to provide evidence that adventure programming is more than just fun and games, and to support it as the powerful form of change that practitioners believe it to be (Priest 1999). The areas that need to be developed are: examining the elements of adventure programming and the means by which these elements bring about change, transferring change to the client's real life, and sustaining that change in the face of a contrary environment. Studies should examine these additional program elements:

- Duration of programs (single versus multi-day).
- Content in terms of activity numbers, lengths, types, and debriefings.
- Location (indoor or outdoor), and setting (urban, rural, or wilderness).
- Follow-up (transfer strategies, reflection, and integration).
- Client types, ideal numbers, and gender.
- Leadership facilitation techniques, teaching styles, and gender effects.

Implications for future research, according to McAvoy (2000), include analyzing program components and models to see how benefits are realized. Inquiry into the adventure experience needs to move into the next stage, from describing the product to understanding the process (Klint 1999). This means examining the "how and why" of the adventure experience, and not focusing on only the "what" of the experience. It also involves looking at each component of the program to determine which elements benefit the participants. There is a greater diversity of participants being studied and this will continue to increase in the future. Multi-method research will be used to conduct research instead of single collection approaches. Increased attention should be given to both secondary as well as primary outcomes in research (Ewert and McAvoy 2000).

Future research in this field needs to address the transference of the benefits of these programs into the work, school, and personal lives of the participants (Ewert and McAvoy 2000). It should address the long-term outcomes of participation in adventure education. As a result, ethics and intrusion issues will continue to be a factor when collecting data.

Future inquiry should also focus on theory-based research. For example, a further examination of self-efficacy theory and which of Bandura's three dimensions of self-efficacy are most susceptible to change in the adventure experience (Klint 1999). Future studies can also look at White's and Harter's theories of competence motivation which include success and failure, degree and type of reinforcement from others, motivational orientation, and perceptions of control. Inquiry into the adventure experience can examine which of these factors are associated with the experience and which factors are related with changes in perceived competence levels (Klint 1999).

According to Henderson and Fox (1994), there are ten important reasons why there needs to be more and better outdoor education research methods and measures. These reasons include: theories and values influence research methods and measures, measurement must be relevant, long-term and in-depth studies are valuable, the challenge of analysis, the diversity of participants, process orientations and group-based studies provide a further dimension, collaborative styles of research will open doors, multiple methods exist for research, to create a demand for research publication, and many critical issues exist in outdoor education.

Recommended Practices

Organizations, such as Outward Bound and NOLS, have set program standards that can be used and applied to any organization in the field with modifications. Each program in the field, no matter its size or population it serves, should examine these standards that have been developed through research and experience. The following recommendations are made based on research and program experience in adventure education and are intended to provide guidance to educators interested in developing and evaluating their programs.

Ethics of Care for Participants

An organization should have defined ethics of care for all participants in an outdoor education program. Ethics of care includes physical and mental safety for the participants, which includes using "challenge by choice." The participants should feel safe while participating in all aspects of the program, which may include physically climbing on a ropes course or participating in a group discussion. It is the responsibility of the leaders and of the organization to create this environment for the participants. The ethics of care for the

participants also includes having a specific ratio of participants to leaders during a given activity. Each outdoor activity has specific ratios and this needs to be addressed by the organization operating the educational program.

Ethics of Care Towards the Environment

If an organization is using the natural environment for outdoor educational programming, they have an ethic of care towards the environment. This includes teaching and practicing minimum impact camping techniques. A wilderness instructor can role model positive environmental behavior and make lessons about the environment enjoyable for the participants. Using a climbing wall or a ropes course, an educator can also share information about the environment with the participants through framing an activity.

Safety of Participants and Staff Members

Safety is a very important best practice in working in the outdoor education field. Safety of the participants and of staff members is essential when operating an effective and efficient organization. Safety includes obtaining background information about participants, communicating program curriculum with participants, and having skills needed for the given activity. The staff needs to know safety protocol of the organization and have written emergency plans accessible at all times. Safety includes training, communication, preparation, and experience of all outdoor educators.

Leaders Who are Qualified with Training and Certification

Leadership skills in adventure education need to include hard, soft, and meta-skills. Parameters for leadership skills that effect changes in knowledge, behavior, skills, and attitudes include effective and efficient leadership. Certification of outdoor leaders has been a topic of discussion in the field. The hard skills are easy to gain and certify and then teach to others. It is worthwhile and beneficial for all concerned to become certified in the specific hard skill they are teaching. For example, becoming a certified wilderness first responder if you are teaching in the wilderness setting or becoming ACA (American Canoeing Association) certified if you are teaching whitewater canoeing. The challenge comes with the soft skills and the meta-skills. How can we certify someone to facilitate or problem-solve? These soft skills need to be taught by each organization to meet that organizations needs. Leadership issues that are part of the best practices in outdoor education include training, awareness, and communication with all levels of management.

Goals and Objectives Matching Organization Needs

Programming for adventure education should be planned and then implemented. For a program to be successful, there should be goals and objectives before it is started. Everyone involved with the program should be aware and understand the goals and objectives. While programming, the organization must look at locations and resources, such as staffing and money, and client groups. The program should be similar to the overall mission statement of the organization. Best practices of the outdoor adventure education field are specific for each organization. Each organization needs to assess their mission statement, goals, and objectives address. They should examine larger organizations with similar goals and objectives and use parts of these programs that can be implemented for their own use.

Skill Development and Awareness for Participants

The purpose of outdoor education is to provide skills and awareness to participants. The skills and awareness that the participants receive will vary depending on the organization. For example, if a group goes backpacking, they should learn minimum impact camping skills, proper fit and adjustments of a backpack, cooking skills for the backcountry, and navigation skills. Each program should specify the skills that participants will achieve through participation and this can be done through a written and verbal curriculum.

Have a Written Curriculum

While examining curriculum in outdoor adventure education, it is important to assess the needs of the program. The knowledge, skills, attitudes and behaviors of the participants and of the staff can be affected by the curriculum of a program. Curriculum needs should focus on safety, skills (hard, soft, and meta-skills), and environmental issues. Specific skills should depend on the activities being taught. By having a written curriculum, the organization can be more effective when working with groups and clients. A curriculum can affect the knowledge that the participants will gain from the program. The curriculum can be written down and once the program is complete, the participants can check off the skills they have gained. Having a written curriculum also enhances the knowledge of the staff, because they then feel more confident and comfortable teaching specific skills. Skills of the participants and staff increase with written curriculum goals and objectives. For example, if the participants are going to learn to canoe a class 3 rapid, they will need to gain the skills necessary to do this safely. Atti-

tudes and behaviors of participants increase with a curriculum. A curriculum provides a guideline, which participants will know about prior to their participation, so they then know what to expect with the experience.

Ongoing Evaluation and Research Benefits the Program and the Field

Ongoing evaluations are important for each organization to be successful. Participants and staff that participate in a given program should complete evaluations. It is also good to get outside resources to conduct research and evaluation on specific programs. Accreditation is a very positive way to make sure your program is up to standards of other similar programs. The peer review process is a positive way to learn about your programs, strengths and weaknesses from other practitioners in the field. Evaluations on a program should be done both summatively and formatively for ongoing program improvement.

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Water-based Outdoor Recreation and Persons with Disabilities

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Abstract – People with disabilities have long been hindered from participating in outdoor recreation activities like fishing and boating because of structural and social barriers. Within the past decade significant progress has been made to include people with disabilities in outdoor recreation programs and improve access to related facilities and lands. This paper summarizes important terminology, legislation, and leisure involvement related to people with disabilities. Using appropriate terminology conveys a sense of inclusion for programs and facilities. Understanding and meeting legal requirements for access to programs, facilities, and services by people with disabilities will further ensure an inclusive environment. Finally, research on people with disabilities shows they have the same motivations and educational needs as others participating in outdoor recreation activities. By using assistive devices and some additional planning; boating, fishing, and stewardship education programs can become inclusive and provide benefits to all segments of the population.

Introduction

Water-based outdoor recreation is a component of our society's leisure involvement. Individuals with disabilities, however, have frequently had less opportunity to engage in water-based outdoor recreation and consequently, to benefit from such involvement. This, however, is gradually changing due in large part to the passage of federal legislation, particularly the Americans with Disabilities Act of 1990.

The world for persons with disabilities has changed significantly in the last thirty years and particularly within the last decade due to changing attitudes, legislation, technological developments, education, and opportunities. Prior to the late 1960s, persons with disabilities were frequently institutionalized or at the least kept out of the mainstream of society and cared for by society. Today, persons with disabilities are coming into the mainstream of society and becoming productive citizens in their own right. Additionally, many are taking and enjoying risks. Consequently, the world of recreation and education opportunities has changed.

Initially, recreation and education opportunities for persons with disabilities, when available, were in institutions or at least at times and place out of the mainstream of society. Next, came community-based recreation and education opportunities that were segregated; that is, programs and even at times facilities operated exclusively for persons with disabilities. Then, programs began to promote integration but in reality such programs were mainly physically integrated rather than physically and socially integrated. Within the latter decade, the move has been towards inclusive recreation and education opportunities where persons with disabilities engage in recreation and education with everyone else. The aim is to change society *from* focusing on an individual's disability *to* focusing on the individual and his/her ability and functioning, and to celebrate individual differences and diversity. Rather than trying always to change the individual with the disability or eliminate the disability, the emphasis is on providing support so individuals can engage in activities of their choosing in the community and at home according to their desires.

The purpose of this paper is two-fold: (a) to review basic information that needs to be considered in the research and design, implementation, and evaluation of water-based outdoor recreation and education programs in terms of persons with disabilities and (b) to identify "best professional practices" related to water-based outdoor recreation and education and persons with disabilities.

Terminology

Before proceeding, it is important to clarify a few key terms. The Figure 1 below highlights relevant terms and corresponding definitions.

Persons with Disabilities

According to the U.S. Department of Commerce (1997), approximately 20% of Americans (i.e., 1 out of 5) have a serious disability. Persons with disabilities are prevalent in every socioeconomic group, age group, ethnic group, religious group, and geographical area and both genders. With the aging of the population and technological advances, the number of persons with disabilities is expected to increase.

Figure 1: Relevant Terms Regarding People with Disabilities

Accessible – "Approachable, functional, and usable by persons with disabilities, independently, safely, and with dignity" (Goldman, 1991, p. 153). The same definition encompasses architectural (physical) accessibility and program accessibility. Accessible is further defined by the regulations that accompany the different laws (e.g., under the Americans with Disabilities Act, accessibility is defined by the Americans with Disabilities Accessibility Guidelines).

Assistive Technology Device – "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capacities of individuals with disabilities" (PL 100-407: Technology-Related Assistance for Individuals with Disabilities Act, SEC. 2561 [3], 1988)

Disability – best defined by the Americans with Disabilities Act, "the term 'disability' means, with respect to an individual – (A) a physical or mental impairment that substantially limits one or more of the major life activities of such individual; (B) a record of such an impairment; or (C) being regarded as having an impairment" (SEC. 3 [2], 1990)

Inclusion – "is the term adopted to describe the process by which persons both with and without disabilities are being served in one environment . . . a program philosophy directed not only to the physical integration of groups of people but to embracing the needs of all within one environment" (Smith, Austin, & Kennedy, 2001, p.257). Further, Bullock and Mahon (2000) state inclusion includes "the cultivation of friendships, the development of natural supports in the community, and related things that are necessary for a person to be reciprocally and mutually accepted in, and connected to, his community" (p. 59).

Integration – physical and social presence of persons with disabilities among persons without disabilities (Bullock and Mahon, 2000)

Normalization – "the utilization of means which are as culturally normative as possible, in order to establish and/or maintain personal behaviours and characteristics which are as culturally normative as possible" (Wolfensberger, 1972, p. 28).

People First Terminology – refers to the words and phrases one employs when referring to persons with disabilities so as to put the person first thereby focusing on the person rather than the disability and to do so in a positive, humanizing manner.

Qualified individual with a disability – The term . . . means an individual with a disability who, with or without reasonable modifications to rules, policies, or practices, the removal of architectural, communication, or transportation barriers, or the provision of auxiliary aids and services, meets the essential eligibility requirements for the receipt of services or the participation in programs or activities provided by a public entity (ADA, SEC 201 [2])

Universal Design – "is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." (The Center for Universal Design, 2001)

Persons with disabilities represent a wide variety of conditions. The basic categories are as follows: (a) physical disability, (b) cognitive disability, (c) emotional disability, (d) social, and (e) multiple disabilities. Within each category, there is a wide variation. Persons may be considered to have a temporary, episodic, or permanent disability present at birth (congenital disability) or due to an accident or illness (acquired disability).

Persons with disabilities are people first. Some persons may consider themselves as having a disability, whereas other persons with similar conditions may not consider themselves as having a disability. The latter is true even if the individuals fit the government

Figure 2: Relevant Federal Statutes for People with Disabilities

Statue (Law)	Title	Abbreviation
PL 90-480	Architectural Barriers Act of 1968 and subsequent Amendments	ABA
PL 93-112	Rehabilitation Act of 1973 and subsequent Amendments	Rehab Act
PL 101-336	Americans with Disabilities Act of 1990	ADA
PL 100-407	Technology-Related Assistance for Individuals for Disabilities Act of 1988 and subsequent Amendments	Tech Act
PL 94-142	Education of All Handicapped Children Act of 1975 and Amendments including PL 101-476 below	EAHCA/EHA
[PL 101-476	Individuals with Disabilities Education Act of 1990 and Amendments]	IDEA
PL 105-359	Study Regarding Improved Outdoor Recreational Access For Persons with Disabilities	

definition of disability. In fact, this is part of the reason it is difficulty to obtain an accurate count of the number of persons with a disability in society today. Regardless of a person's definition of themselves, however, the key is to focus on the person first, hence "people first terminology" and their functioning, and to avoid labels.

The section on "Best Practices" later in this paper will provide more guidance on correct language in relationship to persons with disabilities. For purposes of this paper and "best practices," it is important to adhere to the U.S. government's definitions of disability.

The *2000 National Organization on Disability (N.O.D.)/Harris Survey of Americans with Disabilities* compared the lives of adults with and without disabilities on ten items indicative of quality of life. The ten items were: (1) employment, (2) income, (3) education, (4) health care, (5) transportation, (6) entertainment/going out, (7) socializing, (8) religious participation, (9) political participation/voter registration, and (10) life satisfaction. The study revealed a significant gap between Americans with disabilities and Americans without disabilities on all 10 items. The gaps, however, tended to be less for persons aged 18-29. This may be indicative of a gradual change in society for persons with disabilities. None of the 10 quality of life items directly relate to outdoor recreation and outdoor education; indirectly, however, many of them do. For example, if a person does not have access to transportation they would probably have less of an opportunity to participate in water-based outdoor recreation/education.

Legislation

This paper focuses only on federal legislation; that is federal statutes and federal regulations. Additionally, this paper will only highlight pieces of cited legislation that are relevant to outdoor recreation and outdoor education. It is recommended that readers consult the actual legislation before making any program or construction decisions. Also, it is important to note that there are additional mandates at the local and state levels.

Figure 2 identifies the key federal statutes affecting persons with disabilities in the United States today. These laws provide the foundation for an accessible, inclusive United States in terms of persons with disabilities. Each of these will be discussed below.

Architectural Barriers Act of 1968 (ABA)

The Architectural Barriers Act of 1968 was the first federal legislation passed to "ensure that buildings that are financed with federal funds are designed and constructed to be accessible to the handicapped" (PL 90-480/42 U.S.C.). In essence, ABA addressed only architectural barriers, particularly those involving persons who used wheelchairs for mobility. It did, however, pave the way for persons with disabilities to enter the mainstream of society. The Uniform Federal Accessibility Standards (UFAS) defines accessibility for buildings covered under this act. This act was responsible for the initial accessibility of public outdoor recreation and outdoor education facilities.

Rehabilitation Act of 1973 and Amendments (Rehab Act)

The Rehab Act, most recently amended in 1998, states as one of its purposes to empower individuals with disabilities to maximize employment, economic self-sufficiency, independence, and inclusion and integration into society. In terms of outdoor recreation and outdoor education, the following sections are most significant: - Section 502, Section 504, and Section 508; these sections are found within Title V: Rights and Advocacy. Additionally, there are numerous places throughout the act where recreation and recreation therapy are identified and/or could benefit by funding for initiatives. For example, recreational therapy is identified as a service under community rehabilitation program. Also, recreation and education are areas identified for the use of rehabilitation technology to remove barriers.

Section 504 is what brought prominence to this act in its original form. Section 504 is significance for being nondiscriminatory, though not civil rights, legislation. Section 504 states:

> *No otherwise qualified individual with a disability, as defined in section 7(20), shall, solely by reason of his or her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance or under any program or activity conducted by any Executive agency or by the United States Postal Service.*

The key to the above is the term "qualified individual with a disability" and that only reasonable accommodations need be made that do not cause undue hardship for the federal agency or the agency receiving federal funding.

Section 502 established the Architectural and Transportation Barriers Compliance Board (originally abbreviated as ATBCB; currently referred to as the "Access Board") and defined its functions. Basically, the Access Board is responsible (a) for the establishment and maintenance of accessibility standards related to the Architectural Barriers Act of 1968 and Amendments, the Americans with Disabilities Act, and other federal legislation relating to accessibility for persons with disabilities; (b) to promote accessibility for persons with disabilities in the United States; and (c) to ensure that agencies adhere to the act. Section 508, which is new with the 1998 amendment, adds the requirement of electronic and information technology accessibility to federally funded programs.

In conclusion, the Rehab Act is most significant for extending accessibility to programs and activities rather than limiting it to physical accessible thereby opening more doors for more persons with disabilities to enter the mainstream of society. Its impact, however, is limited to buildings, programs, or activities that receive federal financial assistance. This would include many federally funded water-based outdoor recreation and education opportunities such as facilities, activities, and programs offered by the National Park Service, the United States, Forrest Service, the Bureau of Land Management, and Fishing and Wildlife Service.

Americans with Disabilities Act of 1990 (ADA)

This piece of legislation has had the most far-reaching impact on society and the lives of persons with disabilities. Basically, it is the civil rights act for persons with disabilities. Its intent is to end discrimination and segregation of persons with disabilities and provide persons with disabilities equal access to society. The act consists of five sections: (1) Title I – Employment, (2) Title II -- Public Services, (3) Title III – Public Accommodations and Services Operated by Private Entities, (4) Title IV – Telecommunications, and (5) Title V – Miscellaneous Provisions. Title III is the most significant for recreation and leisure providers. It requires that public entities, regardless of ownership or funding source, be accessible to persons with disabilities with the exception of religion organizations and private clubs. In terms of recreation, leisure, and education, ADA is significant because it has the potential to greatly expand the participation of persons with disabilities in a wide array of opportunities including water-based out-

door recreation and outdoor education. To understand what accessible means, the government has published the ADA Accessibility Guidelines (ADAAG).

The Architectural and Transportation Barriers Compliance Board (Access Board) issue the Americans with Disabilities Act Accessibility Guidelines (ADAAG). General guidelines were first issued in 1991 and most recently amended in 1998. Amendments are anticipated in 2001. Due to the specific nature of certain facilities/activities particularly in the area of recreation, specific guidelines have been and are being created to encompass these areas. For example, in the fall of 2000 Playground Guidelines were issues and signed into law. The government has not adopted guidelines for recreation facilities that will include boating facilities and fishing piers, guidelines for outdoor developed areas that include trails and beaches, nor guidelines for passenger vessels and shore facilities that include fishing cruises. These guidelines are expected out between 2001 - 2003. Such facilities/sites still must adhere to the common items within the ADAAG (e.g., toilets, paths, parking, entrances). Hidden in Title V is "SEC 507 Federal Wilderness Areas." It calls for:

> *(a) Study. – The National Council on Disability shall conduct a study and report on the effect that wilderness designations and wilderness land management practices have on the ability of individuals with disabilities to use and enjoy the National Wilderness Preservation System as established under the Wilderness Act (16 U.S.C. 1131 et seq.).*
>
> *(c) Specific Wilderness Access. – (1) In general. Congress reaffirms that nothing in the Wilderness Act is to be construed as prohibiting the use of a wheelchair in a wilderness area by an individual whose disability requires use of a wheelchair, and consistent with the Wilderness Act no agency is required to provide any form of special treatment or accommodation, or to construct any facilities or modify any conditions of lands within a wilderness area in order to facilitate such use (16 U.S.C. 1131 et seq.).*

Additionally, Title V Sec 507 for the above purposes defines wheelchair as "a device designed solely for use by a mobility-impaired person for locomotion, that is suitable for use in an indoor pedestrian area." The related report is discussed in later sections of this paper (Involvement of Persons with Disabilities in the Outdoors and Best Practices).

The sum results of the ADA is that the vast majority of outdoor recreation and outdoor education opportunities in the United States now must be accessible, architecturally, programmatically, and technologically, to persons with disabilities. Further, persons with disabilities must have the same opportunities within the mainstream of society, as do their peers without disabilities. Although separate programs may be available to persons with disabilities, "separate but equal" is no longer tolerated as the only option or the required option. Since this act is only ten years old and it is still evolving, its impact on the leisure lifestyles of persons with disabilities as well as on the leisure lifestyles of persons without disabilities may not be fully realized yet.

Technology-Related Assistance for Individuals for Disabilities Act of 1988 and subsequent Amendments (Tech Act)

The Tech Act is most significant for its sole focus on technology and persons with disabilities. The original act provided the definition of assistive technology devices (Figure 2) that is most commonly used today and is the basis for similar definitions of assistive technology devices in other legislation. Most importantly, the act recognizes the role of technology in making it possible for persons with disabilities to be fully integrated into society. Assistive technology devices and services related to engagement in recreation, outdoor recreation, and outdoor education are indirectly included in this act. This act as amended in 1994 (PL 103-218) provides funds to states and other entities for training, demonstration projects, research, and exploration of payment options related to assistive technology for persons with disabilities that will enable them to live fuller lives. Therefore, this act has the potential of increasing opportunities for people with severe disabilities to participate in water-based outdoor recreation and education opportunities within the mainstream of society via the availability of assistive technology devices.

Education of All Handicapped Children Act of 1975 and Amendments (EAHCA/EHA) including Individuals with Disabilities Education Act of 1990 and Amendments (IDEA)

This set of laws has had a far-reaching impact on the education of all children with disabilities, ages 3-21. Basically, these laws require a "free, appropriate education" for all children with disabilities. It defines "a child with a disability" more narrowly than the way ADA or Section 504 of the Rehab Act defines "an individual with a disability." According to IDEA,

> The term 'child with a disability' means a child – (i) with mental retardation, hearing im-

> pairments (including deafness), serious emotional disturbance (hereinafter referred to as emotional disturbance), orthopedic impairments, autism, traumatic brain injury, other health impairments, or specific learning disabilities; and (ii) who, by reason thereof, needs special education and related services (20 U.S.C.).

Additionally, for children ages 3-6:

> The term 'child with a disability' for a child aged 3 through 9 may, at the discretion of the State and the local educational agency, include a child – (i) experiencing developmental delays, as defined by the State and as measured by appropriate diagnostic instruments and procedures, in one or more of the following areas: physical development, cognitive development, communication development, social or emotional development, or adaptive development; and (ii) who, by reason thereof, needs special education and related services. (20 U.S.C.)

The law requires that students be educated in the "least restrictive environment," which is defined as:

> IN GENERAL – To the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are not disabled, and special classes, separate schooling, or other removal of children with disabilities from the regular education environment occurs only when the nature of severity of the disability of a child is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactory. (20 U.S.C.)

In essence, the law is promoting inclusion. The law also addresses physical education and recreation. Physical education is seen as a necessary part of all children's education and therefore, children with disabilities must be provided physical education like their peers without disabilities. Further, PL 94-142 defined physical education as:

> *...the development of physical and motor fitness, fundamental motor skills and patterns, and skills in aquatics, dance, and individual and group games and sports (including intramural and lifetime sports). The term includes special physical education, adapted physical education, movement education, and motor development.*

Recreation, including therapeutic recreation, is considered under related services and therefore is not necessary a service provided to all students with disabilities that are covered under PL 94-142/PL 101-476. According to PL 94-142, related services are:

> ...developmental, corrective, and other supportive services may be required to assist a child with a disability to benefit from special education, and includes the early identification and assessment of disabling conditions in children.

Recreation, as identified in this law, includes (a) assessment of recreation and leisure functioning, (b) leisure education, (c) therapeutic recreation, and (d) recreation in school and community agencies.

IDEA, therefore, has the potential to have major impact on the delivery of education services that would promote water-based outdoor recreation and stewardship of the natural environment. Physical education could include such skills as fishing and boating. If a school program includes outdoor education, adventure education, environmental education, school camp, outdoor recreation skill development, or opportunities for engagement in outdoor recreation experiences, then children with disabilities would be included in these programs according to the principle of least restrictive environment. Finally, children with disabilities may receive recreation services as defined above that could provide further opportunities for the development of (a) an appreciation of the natural environment and (b) water-based recreation interests and skills.

Studies Regarding Improved Outdoor Recreational Access For Persons with Disabilities

On January 27, 1998, the above law was enacted. The law required the Secretary of Agriculture and the Secretary of the Interior shall jointly conduct a study regarding ways to improve the access for persons with disabilities to outdoor recreational opportunities (such as fishing, hunting, trapping, wildlife viewing, hiking, boating, and camping) made available to the public on the Federal lands . . . (1) National Forest Systems lands. (2) Units of the National Park System. (3) Areas in the National Wildlife Refuge System. (4) Lands administered by the Bureau of Land Management.

Obviously, the report should have a far-reaching impact on the future of water-based outdoor recreation and outdoor education for persons with disabilities. Wilderness Inquiry undertook the project and the results of the study were published in 1999 in the report entitled, *Improving Access to Outdoor Recreation Opportunities*. The report will be discussed later in this paper

(See sections entitled "Involvement of Persons with Disabilities in the Outdoors" and "Best Practices").

Involvement of Persons With Disabilities in Water-Based Outdoor Recreation and Outdoor Education

Basically, persons with disabilities engage in water-based outdoor recreation for the same purposes of the general population; (a) leisure, (b) education, and (c) therapy. The latter, though more related to persons with disabilities, is not exclusively the domain of persons with disabilities. For example, outdoor recreation including water-based outdoor education is being used with women who have been abused or have low self-esteem (e.g., Outward Bound Programs.).

Leisure Involvement

Three major studies were undertaken in the last decade by the federal government that examined in part the participation of persons with disabilities in outdoor recreation on federal lands. The studies were "The National Survey on Recreation and the Environment" by the United States Forest Service (1995), "Wilderness Accessibility for People with Disabilities" (National Council on Disability, 1992), and "Improving Access to Outdoor Recreation Opportunities on Public Lands" (Lais, 1999).

In the mid-1990s, the United States Forest Service conducted the National Survey on Recreation and the Environment (NSRE) to examine the characteristics, attitudes, and participation patterns of Americans over the age of 15 in terms of outdoor recreation. This study was the first time that respondents were asked if they had a disability. Subsequently, McCormick (2000), examined the data with a focus on persons with disabilities compared to persons without disabilities.

Of the 17,216 respondents surveyed, 1,252 persons indicated that they had a disability; 7.7% of the sample. The majority of respondents with disabilities indicated that their disability was physical in nature; that is, mobility related. The next largest group of respondents was those who indicated their disabilities as "illness" related (e.g., heart condition, diabetes, cancer). The third largest group consisted of individuals who reported their disabilities as "other" (e.g., arthritis, asthma, back problems, epilepsy, and Multiple Sclerosis). The study examined the following categories of activities: sports activities which included walking, swimming activities, outdoor recreation activities, adventure activities which included primitive camping and orienteering, watercraft activities which included water skiing and jet skiing, nature study activities, and cultural/historical activities. The results of the study indicated that first and foremost persons with disabilities engaged in all of these activities. When the rate of participation in the above activities was compared between persons with disabilities and persons without disabilities, variations were found by activity and by age. Additionally, on examining specific activities by days spent engaged in the activity, additional patterns emerged.

McCormick (2000) identified that persons with disabilities under age 25 and over age 75 participated more in outdoor swimming than their peers without disabilities. Individuals with disabilities spent more time outdoors walking than their peers without disabilities. Individuals with disabilities spent equal or more time swimming than their peers without disabilities. When swimming was divided into (a) pool swimming and (b) non-pool swimming and the sub-divisions were examined by age categories, persons without disabilities participated more frequently in non-swimming activities than their peers with disabilities. When participation rates in outdoor activities (i.e., horseback riding, cold water fishing, fresh water fishing, day hiking, organized camping) were examined, in general it was found that persons with disabilities had higher rates of participation than their peers without disabilities. Within specific activities, however, there was a variation. Persons with disabilities participated more frequently than their peers without disabilities in horseback riding, cold-water fishing, fresh water fishing, and day hiking. The data on organized camping did not clearly indicate that one group engaged in the activity more than the other group. In terms of adventure activities, with the exception of rock climbing, persons with disabilities spent more days engaged in these activities than their peers without disabilities. This, however, did vary by age groups. For example, although persons with disabilities on the whole spent more days engaging in primitive camping this changed at age 65 and then persons without disabilities spent more time in this activity. In terms of watercraft activities overall, no significant difference was found in days spent engaging in activities within this category as a whole. For specific activities, however, the number of days spent in the activity varied by whether the person had or did not have a disability. In some instances, persons with the disabilities engaged in the activity more than their peers without disabilities and in other instances they spent fewer or the same number of days in the activity as their peers without disabilities.

Title V, SEC 507 of the ADA mandated that the National Council on Disability undertake a study of persons with disabilities in terms of engagement and enjoyment of activity in National Wilderness Preservation System (NWPS) areas. Wilderness Inquiry conducted the study. The findings were published as "Wilderness Accessibility for People with Disabilities" (i.e., "Wil-

derness Accessibility for People with Disabilities: A Report to the President and the Congress of the United States on Section 507(a) of the Americans with Disabilities Act of 1990 December 1, 1992") and can be found via the National Council on Disability website (www.ncd.gov). The study focused on persons with disabilities involving mobility or sensory impairment. Eighty individuals with disabilities who had previous visited the NWPS areas were surveyed. In terms of assistive devices used in the wilderness, the respondents reported as follows: 50% used manual wheelchairs, 33% used crutches/cane, 16% used no assistive device, 5% used an electric wheelchair, 5% used prostheses, 4% used white cane, 1% used Amigo, and 0% used walker, and 0% used a guide dog. When asked about enjoyment, on a 5 point scale with 5 being "enjoyed a tremendous amount" and 1 being "did not enjoy," the average response was 4.42 with a response of five being given by 55% of the respondents. When respondents were asked why they visited NWPS areas, the most common reason given was "to experience scenery/natural beauty" (93%) while the least common reason given was "to enjoy fishing or hunting" (20%). The majority of persons reported entering the wilderness area by canoe (71%). This was followed next by hike (39%), kayak (29%), and raft (29%).

The PL 105-359 report (Lais, 1999) dealing with access to federal lands for outdoor recreation by persons with disabilities provides additional and more recent information about the involvement of persons with disabilities in water-based outdoor recreation pursuits. Lais found that individuals with disabilities when asked to rate their enjoyment of 16 outdoor recreation activities, rated fishing 5th and human powered boating 6th. In terms of federal land usage, persons with disabilities recreated primarily on National Park Services and National Forest Service lands.

In 2000, the U.S. Department of Interior sponsored the "Disability Rights Summit" which resulted in the paper entitled, *Beyond Awareness: Equal Opportunity for People with Disabilities in the Department of the Interior in the New Millennium.*

Outdoor Education

In light of the fact that laws pertaining to education require that education be provided children with disabilities be educated in the least restrictive environment as possible, it is important to know the impact on learning in such situations. Schleien, Hornfeldt, and McAvoy (1994) examined the impact on environmental/outdoor education when it was provided in as inclusionary situation involving elementary school children with severe developmental disabilities and children without disabilities. The majority of students in the study did not have any disability. In addition, outside this program the students were not educated together. The study demonstrated that the students without the disabilities within an inclusive environmental/outdoor education program learned the food chain concepts being taught in the program. The program included an indoor presentation, demonstrations, and an outdoor educational hike with a naturalist. A variety of techniques were employed to support the children with disabilities: companionship training, cooperative learning, and trainer advocates. Companionship training involved providing the students without the disabilities information on interacting with students with severe developmental disabilities prior to the inclusive outdoor education experience. The students with disabilities' special education teachers functioned as trainer advocates; that is, they provided the companionship training, assisted with the management of the children with disabilities during the program, and assisted the leader of the program, the naturalist, as appropriate. Additionally, a Certified Therapeutic Recreation Specialist (CTRS) prepared the naturalists for the program prior to its initiation.

Organized Camps

Organized camps combine leisure and education. As defined by the American Camping Association (1998), organized camping is:

> A sustained experience which provides a creative, recreational and educational opportunity in group living in the out-of-doors. It utilizes trained leadership and the resources of the natural surroundings to contribute to each camper's mental, physical, social, and spiritual growth. (p.3)

Primarily within the last decade, organized camps have begun to model the school systems and provide inclusive and integrated camping experiences for youngsters with disabilities. Between 1993-1996, the American Camping Association engaged in a study on the impact of residential camp on campers with disabilities; National Camp Evaluation Project (Brannan, Arick, and Fullerton 2001). The study consisted of 2,184 male and female campers, ages 7-21, who had a wide variety of disabilities. They attended one-week summer camp sessions and were enrolled in special education programs. Brannan, Arick, and Fullerton found that among other things the campers made gains in the areas of natural/environment, boating, and swimming. Fishing was not cited. Additionally, campers gained in a variety of psychosocial areas and independence.

Between 1997-2000, the American Camping Association in collaboration with the Institute for Career and Leisure Development engaged in another study that explored the benefits of camping for children with disabilities and without disabilities in inclusionary camps (Brannan, 2000). Entitled "National Inclusive Camp Practices," the study focused on inclusive camp programs. The study was done in phases and involved camps across the country.

Therapy

The outdoor environment particularly through adventure programming has provided an arena for therapy for persons with disabilities. Some of these programs have utilized water-based outdoor recreation activities as part of their modality. It should be made clear, however, that not all persons with disabilities are in need of therapy.

Kelley (1993) undertook a review of literature related to outdoor adventure therapy and adults with mental illness. Many of these programs utilized some form of water-based outdoor recreation component (e.g., canoeing, rafting) in their treatment program. She concluded that:

> No methodologically adequate studies of the effects of outdoor adventure, using psychometrically adequate measurements, appropriate control group comparisons, and appropriate statistical analyses and presentation of data, which have involved representative groups of chronically mentally ill adults, who most often have diagnoses of schizophrenia or major affective disorders. (p. 120)

She did, however, find that both positive and negative effects have been documented regarding the use of outdoor adventure therapy with this population.

Another closely related area is wilderness adventure therapy. This has received much attention from the media in recent years, particularly in terms of adolescents. Davis-Berman, Berman and Capone (1994) surveyed 31 mental health therapeutic wilderness programs. The programs were identified via membership in the Association for Experiential Education. In terms of activities, the researchers found that approximately two-thirds of the programs involved water-based outdoor recreation activities (e.g., canoeing, fishing, rafting). The target populations for these programs were high-risk teenagers with either a history or a potential of a psychiatric diagnosis. Davis-Berman, Berman, & Capone discovered much diversity in programs, a lack of specifics regarding the program, and the omission of program and outcome evaluation. Additionally, the researchers had difficulty deciphering whether a program was therapy or therapeutic.

Weston, Tinley, and O'Dell (1999) also examined the literature on this topic in terms of such programs for adolescents-at-risk. Their results are similar to findings of Kelley (1993) and Davis-Berman, Berman, & Capone (1994); that is, there is a lack of quality evaluation and rigorous research and reporting related to this area. Without such, no conclusions can be made regarding the outcomes (benefits) of these types of programs. It should be noted that none of the studies identified the impact of this type of programming on the participants' current or later leisure lifestyle or even noted if this was explored.

Physical rehabilitation programs, however, have tended to incorporate outdoor recreation skill development into their outdoor therapy programs. Three examples are Craig Rehabilitation Institute (Denver, CO), Shake-A-Leg (Newport, RI), and Shepherd Rehabilitation Center (Atlanta, GA). No research, however, was found related to the outcomes of these programs for the participants.

Benefits of Outdoor Experiences on Fishing, Boating, and Stewardship

The vast majority of outdoor recreation, outdoor education, camping, and therapy programs involving persons with disabilities reported results related to gains in psychosocial areas such as self-esteem and friendship as well as gains in independence. Only a few studies, however, examined the relationship of these types of programs for persons with disabilities in either segregated or inclusive settings on leisure lifestyle, leisure skills, or stewardship of the natural environment. The studies affiliated with the American Camping Association did address these issues (Brannan, ?; Brannan et al ?). Brannan and his associates found that in addition to psychosocial development, campers with disabilities gained boating skills and appreciation of the natural environment as a result of their participation in organized camp programs.

McAvoy et al (1989) discovered that wilderness programs that included persons with and without disabilities resulted in gains for all participants in the areas of environmental appreciation, psychosocial development, and recreation skills and patterns. Anderson, Schleien, McAvoy, Lais and Seligmann (1997) found that inclusive outdoor adventure experiences centering around wilderness canoe trips resulted in a significant increase in canoeing skills, particularly for persons with disabilities. Additionally, the researchers found that par-

ticipants gained in outdoor skills and experienced psychosocial growth.

McCormick (2000) in examining the NSRE data found that individuals with disabilities who had engaged in activity in the National Wilderness Preservation System (NWPS) more strongly supported less accessible accommodations and preservation of the environment in NWPS compared to individuals with disabilities that had not engaged in activity in the NWPS. This may be interpreted to mean that one benefit of participation in wilderness activity is a desire to preserve the area.

Constraints to Participation

Constraints to involvement in activity and the community, in general and in outdoor recreation in particular, for persons with disabilities tend to involve attitudes and resources. Attitudes can be defined as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein & Ajzen, 1975, p.15). Attitudinal barriers for persons with disabilities in terms of leisure participation include their own attitudes as well as attitudes of the significant others, the community or society at large, and the providers (Ross, 1993). Resources include finances, transportation, assistance or support of another person, leisure partner, knowledge and skills, and functioning.

Germ and Schleien (1997) examined constraints to leisure participation for persons within the context of community leisure agencies. Consumers (i.e., persons with disabilities) identified transportation and program issues as barriers to participation. Program barriers included the lack of inclusive programs for adult males and teenagers with disabilities, the lack of a variety of program times, and the lack of skill development programs at the appropriate level.

Ross (1993) found that for young adults with recent spinal cord injuries transportation, lack of a leisure partner, mobility, self-consciousness, and attitudes of significant others were barriers to outdoor recreation pursuits. Wilhite and Keller (1992) examined the leisure involvement of older adults with developmental disabilities. Leisure constraints reported by these adults included money, transportation, physical accessibility, concerns about their behavior, and discomfort in large public groups. Additionally, some of the respondents "who perceived that they were not integrated, felt community members were not sensitive to their needs nor willing to allow them to be integrated into community life and activities" (p.25).

McCormick (2000) found on analyzing the NSRE study that persons with disabilities identified more barriers to outdoor recreation on U.S. Forest land than persons without disabilities. The primary barriers to outdoor recreation participation for persons with disabilities revolved around health and physical functioning. Further, these barriers were cited by over 50% of the respondents with disabilities. Lais (1999), focusing more specifically on barriers to fishing on federal lands reported, based on participants' responses, that the barriers were: "eroded or heavily vegetated fishing banks, or docks and piers that are too narrow, have steps, or are in disrepair" (p. 29).

Best Practices

Accessibility

Accessibility is defined by federal, state, and local legislation/codes. In terms of the outdoor environment, standards currently exist regarding facilities (e.g., bathrooms, education centers) but few standards apply to the natural environment. Such standards are, however, in the process of being adopted. The major question though is how accessible should the natural environment be for persons with disabilities. The US Forest Service in their study entitled "National Survey on Recreation and the Environment" (NSRE) attempted to explore this question in terms of federal land. McCormick (2000) in his analysis of the data found conflicting views. On one hand, individuals with disabilities voiced acceptance of less accessibility within more primitive environments and for preservation of the wilderness, yet they also indicated a desire for modifications, including environmental modifications, to accommodate people with disabilities.

Inclusion

A number of studies have recently examined means towards inclusion. A few were reviewed above under "Involvement of Persons with Disabilities in Water-Based Outdoor Recreation and Outdoor Education." Modell and Imwold (1998) examined parental attitudes regarding inclusive recreation programs involving children with and without mental retardation. Parents identified the following benefits of such programs: normalization, communication, learning about diversity, social interaction, friendships, and socialization. Parents also identified the following attitudinal barriers and programmatic barriers: "safety, lack of programs, age-appropriateness, lack of acceptance, and ignorance" (p. 92).

Klingner and Vaughn (1999) examined 20 research studies regarding the inclusion of students with learning

Figure 3: Dehumanizing Language vs. Humanizing Language

Do not use	Use
The person who is crazy.	The person with mental illness.
The person who is wheelchair bound	The person who uses a wheelchair
The person who is confined to a wheelchair	The person who uses a wheelchair
The deformed person	The person with a physical impairment
The cripple	The person with a physical impairment
The blind	The person who is blind
The retarded	The person with mental retardation
The person who is a stroke victim	The person who had a stroke
Deaf and dumb/mute	The person who is deaf and does not speak

disabilities into the general education classroom, grades kindergarten through 12. They focused on the students', both those with and without disabilities, perceptions regarding classroom practices. Klingner and Vaughn concluded that students preferred help from the teacher, active learning situations, and working in pairs or groups. Specifically, in terms of teacher behavior the following was identified as helpful: "(a) explains lessons carefully, (b) helps with math or reading, (c) gives extra time for work, (d) provides student choices, (e) includes opportunities for interpersonal social interactions, (f) provides opportunities for creative expression, (g) includes format variety, and (h) provides for optimal challenge" (p. 29). Students did not like it when "teachers are inconsistent, spend too much time on classroom management [behavior management], and give negative feedback" (p. 31). Further, the students wanted all students to be treated the same yet accepted recognized individual learning differences/styles. Additionally, students "did not perceive instructional adaptations and accommodations to meet the special needs of selected students as problematic" (p. 30).

Snyder (1999) explored the attitudes and concerns of general educators in terms of inclusion. Basically, she found that the teachers did not feel supported by the administration, that they were not offered the necessary training, and that there needed to be more collaboration between general education teachers and special education teachers. Daane, Beirne-Smith, and Latham (2000) and Smith (2000) reported comparable findings. Similarly, Bogle (1996) explored inclusion in Canadian camps and concluded that counselor training was the key to successful inclusion.

Fisher, Sax, Rodifer, and Pumpian (1999) examined the perceptions of general secondary educators towards inclusion in a school that had had at least 4 years of experience in inclusive education, included students with severe disabilities in inclusion, and was ethnically diversified. They found that the teachers reported positive impact of inclusion on themselves as well as on the students without disabilities and the classroom climate. Basically, the general educators made the following recommendations for successful inclusion: (1) "ongoing interactions and contact with special education teachers and staff" and (2) "use of peer support strategies," (3) "curriculum adaptations and information about the students with disabilities" (p. 262). The teachers, however, did indicate a desire for more support from peer tutors, aides, or special education teachers; concern about not enough work for the students with disabilities; and disruptive behavior from both students with and without disabilities.

Bennett, Deluca, and Bruns (1997) studied what components lead to "successful inclusion" from the perspective of parents and teachers. The following factors were identified in making inclusion work: commitment by the teachers, administrators, and parents; teacher qualities including flexibility, "open-mindedness, a sense of humor, and an ability to communicate with other adults" (p. 125); teachers' attitudes; and the availability of resources (e.g., planning time, support staff).

Guidelines

Best practices must first demonstrate respect for and maintain the dignity of all individuals including the persons with disabilities. This is partially accomplished by the use of people-first language and principles of inclusion and normalization. Means for this are outlined in Figures 3, 4, and 5.

Figure 4: People First Language

Person with a disability
Individual who uses a wheelchair for mobility
Person who has a vision impairment

Figure 5: Principles of Inclusion

- Celebrates diversity
- Respects differences
- Interdependence
- Participation and cooperation
- Supportive relationships
- Friendships
- More than integration and accessibility

For additional guidelines relating to language and persons with disabilities, one is referred to the "Guidelines for Reporting and Writing about People with Disabilities" (5th ed.) written and published by Media Project, Research and Training Center on Independent Living , University of Kansas.

Secondly, best practices must conform to appropriate legislation. Basically, that means that programs and facilities should be inclusive and accessible, facilities should employ universal design, and assistive technology devices should be available whenever possible. In terms of fishing, Lais (1999) specifically recommended the following:

- All fishing piers and structures comply with the recommendations currently being advanced by the federal Access Board.
- On advertised bank fishing locations, secondary undergrowth at key access locations should be cleared to allow access to the fishing opportunities to persons with mobility impairments, unless this clearing would diminish the resource due to erosion or the removal of rare or endangered species, or fundamentally alter the natural environment or recreational experience of the setting. (p.19).

In terms of boating, he recommended that "access and assure that all docks and piers comply with the recent additions to the ADAAG standards put forward by the Access Board" (p. 21).

Lais also indicated a need to "clarify the balance between resource protection and accessibility" (p. 5). Finally, he stated that:

> Although popular with many people, it is recommended that federal land management agencies promote special treatment of persons with disabilities only as a last resort when such treatment is truly required to provide equal opportunity. In other words, special treatment should be used only when it is proven impossible to integrate people with disabilities into existing programs for the general public. (p. 23)

Finally, in terms of outdoor education and outdoor recreation programs, the following guidelines are offered:

1. Provide pre-training and continual training to staff.
2. Consider having a CTRS (Certified Therapeutic Recreation Specialist) available as a consultant.
3. Collaborate with special educators.
4. Have students work in pairs and small groups.
5. Use a variety of active teaching methods.
6. Make accommodations and adaptations as necessary.
7. Provide instructors with support staff.
8. Include accessibility information in all marketing and informational material and be sure that such materials are written positively and available in an accessible format to persons with disabilities.
9. Provide sensitivity and awareness training to staff and participants that includes information related to persons with disabilities, disabilities, interacting with persons with disabilities, and diversity.
10. Staff should include persons with disabilities.
11. Involve persons with disabilities in the design and implementation of programs.
12. Support persons including sign language interpreters and personal care attendants should be available and if accompanying the participant, not be charged.

Exemplary Programs

There are a number of programs in operation today that demonstrate the above guidelines. At this point, only a few will be noted. The resource list contains some others. In terms of inclusion programming, Wilderness Inquiry based out of Minneapolis, MN comes to the forefront. It is a non-profit program that aims to provide outdoor adventure activity to persons with and

without disabilities within a single program. Diversity, interdependence, and environmental preservation are its cornerstone. It provides a variety of outdoor recreation adventures (trips) for persons of all ages and all abilities.

The Commonwealth of Massachusetts Department of Environmental Management that oversees the Massachusetts State Forest and Parks system initiated the Universal Access Program a few years ago. The program uses people first terminology in all its publications, provides sign language interpreters and other support personal for its programs, and offers a variety of assistive technology equipment so that individuals with disabilities may full engage in outdoor pursuits at the parks. Publications are offered in a variety of mediums including on audiotapes. Hiking trails are in two varieties; "accessible trails" which met universal accessibility standards and "accessed trails" which are more rugged. Also, a wide variety of outdoor recreation skill instruction is available in such activities as sea kayaking, rowing, cross-country skiing, and ice skating. Finally, a major effort has been made in making the parks facilities accessible including camping and picnicking areas, fishing piers, and beach areas.

A relative new comer is the Access Nature Project, that is a joint program between the National Wildlife Foundation and Easter Seals Virginia. It is funded by a federal grant. The program, still in the developmental stages, is intended to provide inclusive outdoor education that facilitates the acquisition of outdoor skills, environmental awareness, and leadership. If successful, this program should complement the objectives of the Boating and Fishing Foundation.

Conclusions and Recommendations for Research

There is a lack of research available concerning methods of providing individuals with disabilities with water-based outdoor recreation and outdoor education experiences that facilitate the development of lifelong interests and skills as well as an attitude of stewardship for natural water areas. Legislation, however, directs the provision of such leisure and educational opportunities. It is unclear what the (a) relationship is among outdoor education, outdoor recreation, and stewardship; (b) what the best context and methods are for providing outdoor education and outdoor education experiences for persons with disabilities especially that would facilitate development of fishing and boating skills and stewardship of the water-based outdoor environment. Specifically, the following recommendations are made for research:

1. Explore the efficacy of inclusive water-based outdoor recreation experiences in promoting stewardship of the water-based outdoor environment for persons with disabilities.
2. Explore if there is a minimum depth of experience that is necessary to enable stewardship to develop for persons with disabilities.
3. Explore if there is a minimum level of outdoor recreation skills persons with disabilities must obtain to incorporate fishing and boating into their leisure lifestyle.
4. Explore the relationship between water-based leisure involvement, functioning in terms of disability,
5. Explore the relationship of the instructor/recreation leader's attitude towards inclusion and persons with disabilities on the participants' acquisition of recreation skills, interests, and attitudes related to the natural water-based outdoor environment.
6. Explore if there is a relationship between modified of the environment for accessibility and attitude towards preservation of natural resources.
7. Explore techniques for enabling all persons to gain the most enjoyment and skills in water-based outdoor recreation.
8. Further explore constraints to water-based outdoor recreation and outdoor education for persons with disabilities.
9. Explore the role of virtual reality in developing water-based outdoor recreation skills as well as stewardship.

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Recommended Educational Practices for Youth Environmental Education From a 4-H Youth Development Perspective

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Abstract – Key concepts to keep in mind about best practices of curriculum design and program development for youth in non-formal settings include:

- It helps if the organization can agree on curriculum criteria and come to consensus on what is the balance between content and process skills.
- Teaching experientially is the preferred mode for non-formal education, but becoming proficient at designing learning experiences by mapping it along an experiential path continues to be a challenge.
- The late 80's ushered in the *Youth at Risk* movement fueled by research on risk and protective factors. This was counteracted in the early 90's with the youth asset driven model advocated by the Search Institute and has evolved into a *Best Practices of Positive Youth Development Model* that is fueled by a renewed commitment to meaningful youth/adult partnerships, experiential learning and civic activism.
- The paradigm shift from youth participation for *youth development* to youth—adult partnerships for *community change* (i.e. Community youth development) promises to be a natural evolution of the youth development movement.

Although there is not a wealth of materials on boating, fishing and environmental stewardship available in the National 4-H Curriculum Collections, many states and counties are using materials on a local level that truly work for them. This presents a key opportunity for partnerships to evolve. Both the Logic Model of program evaluation as well the Four-Fold Model designed to evaluate 4-H Youth Development curriculum are two major models that are currently being used in 4-H Youth Development programs.

Researchers need to utilize Youth–Adult Partnerships, which fully engage youth and adults in research related activities defining best practices focused on:

- Implementing youth–adult partnerships in diverse communities.
- Engaging community based youth—adult partnerships in creating their own experiential based curriculum.
- Implementing interactive technology based learning in community organizations.
- Defining strategies for moving from a positive youth development model to a community – youth development framework that harnesses the energy, creativity and dedication of both youth and adults to create community change.
- Developing an international version of this emerging community youth development framework that could be adaptable around the world.

Non-profit organizations, like the Recreational Boating and Fishing Foundation (RBFF), could work with youth development researchers and practitioners to create a sustainable grassroots movement to mobilize youth and adult partners to conserve and restore our nation's aquatic natural resources by getting involved in boating and fishing.
The author urges RBFF to continue to utilize marketing and education strategies to increase public awareness for protecting, conserving and restoring this nation's aquatic natural resources. This lofty goal combined with integrating research and practice on youth—adult partnerships, experiential learning strategies and the community youth development movement will help develop a sustainable learning community that brings about lasting change in how communities deal with issues related to boating, fishing and environmental stewardship.

Best Practice For Designing Curricula Materials

Development of National Criteria for 4-H Youth Development Curricula

For over 80 years 4-H curriculum materials evolved in a rather haphazard manner in each state. In fact, a 1986 survey found 40 different state 4-H Beef project materials. Therefore, there was a need to standardize criteria and collaborate as a truly cooperative system. The following criteria was created by the National 4-H Curriculum Developmental Committee, modified and piloted by the Youth K-3 (5-8) Task Force, amplified during the 1993 Curriculum Staff Pre-conference, and refined by the National 4-H Experiential Learning Design Team. They were then condensed and sharpened from 35 to the present 14 in a 3-round Delphi process involving nearly 300 staff from nearly all States and Territories. The criteria and procedures were revised 10/95, 10/97, 10/99, and will be re-examined annually. The National 4-H Curriculum criteria include the following 14 points:

Experiential Learning Methodology

- The instructional approach of the materials is experiential education. Through vital practice, young people actively learn, then share their experiences, reflect on its importance, connect it to real world examples, and apply the resulting knowledge to other situations.
- Opportunities are included for involving volunteers and youth as partners in planning, implementing and evaluating the learning process.
- Materials are user friendly, and identify the intended delivery mode(s) for the curriculum.

Learner Centered

- The educational materials include a variety of educational experiences for varied learning styles. They build on various knowledge bases and are applicable to real world situations and current societal issues.
- The reading level, subject matter, learning experiences, incentives and recognition are developmentally appropriate for the intended audiences and allow for varying participant experience levels.
- The educational materials encourage positive attitudes toward learning by being presented in a fun, appealing, engaging and challenging manner that is consistent with learning theories.

- The educational materials identify and target one or more outcomes or skills, which are highly transferable, broadly useful beyond the subject matter, or throughout life. These may come from any source, such as life-skills lists, workforce competencies, science process skills or internal assets, etc.
- The educational material is sensitive, reflective and respectful of audience diversity in income, race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, marital status or family status.

Subject Matter Content

- Uses research-based human development methodology and subject matter knowledge from the land grant system, other universities, and/or other sources. Facts and terminology are accurate, current, and used appropriately.
- Subject matter is used as a vehicle through which growth and development of the learner occurs.
- Design, format, and packaging of the educational materials are appropriate to the intended audience, the subject matter, and the media used.

Objectives and Evaluation

- Goals, outcomes or objectives are clearly stated. The educational materials appear to be efficient in the time, effort and materials necessary to achieve objectives.
- Evaluation experiences or tools are suggested or included which provide participants feedback on their accomplishments.
- Evidence is provided that participants using this material generally achieve the major objectives.

The National 4-H Curriculum Collection includes curricula, which have met each of the 14 specific criteria. Over 400 curricula have been submitted for review. Of these, 135 have been accepted into the National 4-H Curriculum Collection and are recommended for use in all states and territories. Forty-five of these, now over five years old have been removed. Citations for each item now in the National Collection can be found at this website:

http://www.reeusda.gov/4h/curricul/curricul.htm.

Defining Developmentally Appropriate Life Skills

One of the basic building blocks of 4-H Youth Development curriculum is the concept of teaching life skills. In 1973, in the "4-H in Century Three" planning document, state 4-H Leaders endorsed the notion that 4-H was not just about providing knowledge, skills and

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understanding of subjects that the individual elects for personal involvement. In addition, 4-H had the dual purpose of building socially desirable "life skills" in boys and girls (Informal paper, Allan Smith, 1996), Over the past three decades 4-H Youth Development educators have struggled with how to clearly articulate and integrate life skills into curriculum materials. On major contribution to this dialogue was Dr. Patricia Hendricks' Targeting Life Skills Model (1996, revised 1998).

The Targeting Life Skills model was important for it provided 4-H Youth Development curriculum designers with a set of resources to help them:

- Better understand life skill development by using the 4-H clover to identify and sort 35 life skills .
- Clearly define the appropriate developmental level for each of these 35 life skills.
- Write life skill development impacts that are measurable.
- Create learning opportunities based on experiential learning theory.
- Use identifiable observable indicators to measure program impact.

Toward a Better Understanding of the Experiential Learning Model

The Targeting Life Skills handbook provided Curriculum Designers with tools to better integrate life skills into 4-H materials and served as a major building block for 4-H Curriculum Specialists. The concept of life skills was broadened with the Four-Fold model that combined four existing models into one comprehensive model:

- The SCANS Workforce Preparation model (1991).
- The Science Process Skill model developed by the National Network for Science and Technology (1997).
- Iowa State University's Targeting Life Skill model (1998).
- The Search Institute's Internal Assets model (1998).

This comprehensive model focuses on the four-fold development of an individual youth's head, heart, hands and health and encouraged 4-H Youth Development educators to target one or more outcomes or skills which are highly transferable and broadly useful beyond the subject matter, or throughout life. These skills are not just 4-H life skills, but may come from other sources, such as workforce competencies, science process skills or internal assets, etc.

Still the debate raged on between subject matter specialists and youth development specialists as to what was more important—life skill development or acquisition of subject matter knowledge. In 1998, Dr. Robert Horton, a curriculum specialist at Ohio State Cooperative Extension noted that 4-H curriculum designers:

> *Assumed an either-or posture; one either supports a design with the content as the core or a design with skills at the core. Recently, however, experiential curriculum designers have conceded that we need to meld our curricular concerns relating to both the subject matter of the curriculum and the personal skills of the learner. The whole intent is to get* ***students more meaningfully involved with content*** *so that more of the knowledge and skills stick by allowing them to take more responsibility for their learning." One of the best ways to do this was to design materials using the Experiential Learning Model.*

Now that 4-H curriculum designers seemed to agree that they needed to design curricula that blended both life skills with subject matter content, they needed to get a better handle on the Experiential Learning model. Educators would nod their heads and agree that the Experiential Learning Model was important, for it supported the age old 4-H slogan of *learn by doing*, but most people did not have a real clear idea about how to design experiential learning activities. Many curriculum designers became comfortable using the format advocated in the 4-H Animal Science Skills for Living series, that was useful at it's time of introduction in the early 90's, but found this approach was not adaptable for all 4-H project areas.

Barkman and Horton (1999) defined Experiential Education as:

- Based on the needs and interests of the learner.
- Utilizes non-formal instruction.
- Learning facilitator is present.
- Experiences are organized in a way that moves learners through four distinct phases; introduction, exploration, generalization and applications.

In *Experiential Learning: Experience as the Source of Learning and Development* (1984), Kolb describes experiential learning as a holistic, integrative approach. Kolb postulates that instructional content is best organized along an ***experiential path***, where

learning takes place as a series of transactions among four adaptive modes:

- Concrete experience
- Reflective observation
- Abstract conceptualization
- Active experimentation.

Horton et al. (1999) suggest an eleven-step model for the Developing Experientially Based Curriculum Materials and Evaluation of Experientially Based 4-H Curriculum. These steps include:

Part I - Framing the Unit
Step 1: Establish the Unit's Theme
Step 2: Assess the learner's needs and interests, define the context in which learning will occur and determine how curriculum will be packaged.
Step 3: Write performance outcomes.

Part II – The Curriculum Planning Process
Step 4: Develop scope and sequence.
Step 5: Determine depth of experience for each topic.
Step 6: Design learning activities.
Step 7: Develop facilitation activities.
Step 8: Complete written draft of entire curriculum.
Step 9: Design Pilot version with layout and graphics.

Part II – Verification and Revision
Step 10: Conduct pilot test and revise.
Step 11: Print or produce final curriculum.

Horton et al. (1999) reviewed the work of 19 individuals to develop this prescription for operationalizing experiential curriculum philosophy. Their model provides an in-depth description on how to integrate the experiential learning model into the curriculum design process. Horton attempts to get at the *heart of experiential learning* by encouraging curriculum designers to organize content in a manner that takes into account how individuals develop and learn. He encourages learning facilitators to feel free to skip around and address content based on the interests of the learner. A variety of approaches can be used to *map out the experiential*).

Let's closely consider these four steps of Horton's curriculum design model.

Step One: Organize themes around the interests of the learner, rather than on the demands of academic subjects.
Step Two: Determine the depth of experience for the content by mapping along the experiential path.
Step Three: Construct learning activities that address content at its assigned location along the experiential path, with consideration for content outcomes and the skill set.
Step Four: Provide evidence that *experiential processing* takes place.

In this non-formal setting, teachers are cast as facilitators of learning rather than directors as characterized in all formal situations. If taken seriously, these four strategies really help to strengthen the experiential learning process. Horton also encourages curriculum designers to create ways for others to intervene in the learning process by providing focus, support and feedback, and debriefing. Creating experiential learning environments is not easy task, but these strategies are a start. Horton's work gave 4-H youth development professionals the tools to create curriculum materials based on utilizing current research on experiential learning, rather than just using a *cookie cutter* approach for mass producing volumes of *look alike* 4-H project manuals based on only one successful curriculum format. Now let's look at the parameters of best practice in youth development programs.

Best Practices Supporting Youth Development Programs

Zeldin (2000) noted that it is hard to believe how quickly the phrase *positive youth development* became ingrained in the language of research and practice. Preventing youth problems dominated research and policy agendas throughout the 1980's and into the early 1990's. Classic examples of this orientation include Dryfoos (1990) and Jessor (1977). Youth at Risk was the buzz phrase of the 80's supported by research on risk and protective factors. The early 90's saw the expansion and consolidation of lessons learned from prevention and other risk-oriented models along with a revisitation of theory and practice in experiential and civic education. This resulted in an emphasis on youth issues and associated recommendations for policy and practices. This approach was labeled ***positive youth development***. One of the major forces in this movement that was the work done by the Search Institute on developmental assets.

Search Institutes Asset Model

Since 1990, the Search Institute has been refining a framework of 40 developmental assets. This influential framework has laid the groundwork for best practices of youth development to evolve to its present state. Many youth development educators across the nation have considered these factors as they have de-

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veloped programs to help youth grow to be healthy, caring and responsible.

The Search Institute is an independent, nonprofit, nonsectarian organization whose mission is to advance the well being of adolescents and children by generating knowledge and promoting its application. To accomplish this mission, the institute generates, synthesizes, and communicates new knowledge, convenes organizational and community leaders, and works with state and national organizations.

At the heart of the institute's work is the framework of 40 developmental assets, which are positive experiences, relationships, opportunities, and personal qualities that young people need to grow up healthy, caring, and responsible. Created in 1990, the framework is grounded in research on child and adolescent development, risk prevention, and resiliency. Surveys of more than one million 6th-12th-grade youth in communities across the United States consistently show that young people who experience more of these assets are more likely to make healthy choices and avoid a wide range of high-risk behaviors. The relative absence of these assets in the lives of young people in every community studied has prompted hundreds of communities to mobilize on behalf of young people.

External Assets

The first 20 developmental assets focus on positive experiences that young people receive from the people and institutions in their lives. Four categories of external assets are included in the framework:

Support - Young people need to experience support, care, and love from their families, neighbors, and many others. They need organizations and institutions that provide positive, supportive environments.

Empowerment - Young people need to be valued by their community and have opportunities to contribute to others. For this to occur, they must be safe and feel secure.

Boundaries and expectations - Young people need to know what is expected of them and whether activities and behaviors are *in bounds* and *out of bounds*.

Constructive use of time - Young people need constructive, enriching opportunities for growth through creative activities, youth programs, congregational involvement, and quality time at home.

Internal Assets

A community's responsibility for its young does not end with the provision of external assets. There needs to be a similar commitment to nurturing the internal qualities that guide choices and create a sense of centeredness, purpose, and focus. Indeed, shaping internal dispositions that encourage wise, responsible, and compassionate judgments is particularly important in a society that prizes individualism. Four categories of internal assets are included in the framework:

Commitment to learning - Young people need to develop a lifelong commitment to education and learning.

Positive values - Youth need to develop strong values that guide their choices.

Social competencies - Young people need skills and competencies that equip them to make positive choices, to build relationships, and to succeed in life.

Positive identity - Young people need a strong sense of their own power, purpose, worth, and promise.

Best Practice of Youth Development Programs

From 1993 to 1995, a nationwide project was launched to answer the fundamental question: "What are the day-to-day experiences that are essential for young people to be able to participate successfully in adolescent and adult life?" The answer, based on evidence from a review of 12 task forces and synthesis reports, and a review of more than 200 research studies is simple. Young people need access to safe places, challenging experiences, and caring people on a daily basis (Zeldin & Price, 1995).

In February 1999, Wisconsin 4-H Youth Development staff engaged in an initiative to confirm and expand these research findings by gaining the collective knowledge and wisdom of the those who work with youth in the field. All staff participated in a series of conference activities and shared learning exercise to further explore the essential experiences, an equally important, to identify ***best practices*** that are associated with the essential elements (Zeldin, Day & Matysik, 1999).

During 1999, these ***essential experiences*** and ***best practices*** were presented to staff and discussed throughout Wisconsin. Modifications were made accordingly. This consistency across research and experience was the basis of the work with the Program and Activity Assessment Tool (PAAT). This tool is intended to assist youth development professionals in assessing the level of essential opportunities and sup-

ports that must be in place in order for youth to have healthy and rewarding experiences. The directory of Best Practices includes the following items.

Youth need opportunities for:
- Exploration and Reflection
- Expression and Creativity
- Group Membership
- Contribution and Service
- Part Time Employment.

Youth need support through:
- Nurturance and Friendship
- Emotional Safety
- High Expectations
- Standards and Boundaries
- Access to Resources.

Youth programs need organizational support such as:
- Trained professionals and volunteer staff
- Partnerships and collaborations
- Regular evaluation and assessment.

Zeldin (2000) emphasizes that this directory is obviously not exhaustive. It merely illustrates how researchers and practitioners articulate what the essential experiences *look like in practice*. The purpose of this directory is to provide grounding for using PAAT. This tool can help youth development professionals strengthen their programming regardless of the setting in which they are working

This concludes the discussion on program development models. One can see how the practice has evolved from the prevention model of the 80's that focused on risks and negative behavior, then swung to the asset model that focussed on the positive things youth need to possess. The current *positive youth development* model advocated by Zeldin (2000) and others appears to be an evolution of both the prevention and asset model and moves on to identify *best practices* associated with the essential elements of positive youth development. Now let's look at some key youth leadership models that are supporting current youth development practice.

Best Practices for Youth Leadership Models

The Youth—Adult Partnerships Leadership Model

The spirit and philosophy behind the Youth—Adult partnership leadership model is nothing new. In fact, in 1974 the National Commission on Resources for Youth advocated a partnership model in which "There is mutuality in teaching and learning and where each age group sees itself as a resource for the others and offers what it uniquely can provide". This coupled with youth power in decision-making distinguishes youth-adult partnerships from parent-child, student-teacher and mentoring relationships. For example, mentoring emphasizes different principles such as:

- Helping youth develop a specific skill.
- Providing nurturance (adults giving youth the care and support that they need to thrive).
- Generativity (i.e. adult mentors passing on knowledge and wisdom to their young).

In contrast, youth-adult partnerships are a key strategy for community building. Camino (2000) noted three major premises of this movement:

- Strong communities are built on active participation and civic engagement of all members.

- Youth development is predicated on a larger focus on building healthy communities. If youth are able to participate in civic and public affairs as participants, not solely as beneficiaries, they tend to experience optimal development.
- Adults can overcome negative attitudes and misinformation about youth if they join with youth to address community concerns.

The Next Paradigm Shift: From Youth Participation for Youth Development to Youth—Adult Partnerships for Community Change

Young people do not grow up in programs they grow up in communities. The argument that meaningful participation is critical to youth development has been well documented. But the idea that youth participation is critical to community change has not been firmly embraced (Pittman, 2000). Pittman goes on to note that the next definition shift will be from "problem youth" to "problem solvers". Pittman warns about the danger of the "early investment" push, combined with the lingering "fix then develop" mentality which makes it less likely that young people most in need of services and opportunities will get them. Pittman notes that, "We will do a disservice to all young people if we do not find ways to create the public idea of youth as change agents: one that starts rather than concludes with the engagement of young people whose lives and communities are most in the need of changing." Pittman closes by challenging readers that to maximize impact, youth participation must be seen as:

- Critical to the immediate well being of communities and institutions not just the youth involved.

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- Occurring everywhere, not just in separate youth specific projects.
- Involving learning and work, as opposed to uncompensated volunteering which is detached from career interests.
- The right and responsibilities of all young people.

One entity that continues to push the concept of *community youth development* is the Innovation Center for Youth Development and Community Development. This is a division of National 4-H Council. It's mission it "To advance the 4-H youth development movement to build a world in which youth and adults learn, grow and work together as catalysts for positive change". The Innovation Center promotes effective tools and strategies for engaging youth and adults as partners in creating positive community change in both urban and rural areas. Guiding principles that drive this organization include the following:

Guiding principles —Youth

- Young people bring valuable experience, knowledge and ideas to ventures. When their contributions are included, everyone benefits.
- Young people and adults can be equal partners in building communities and creating change. Youth/adult partnerships are powerful, effective, and practical.
- Youth development focuses on youth as who they are now, not only on youth as future adults.

Guiding Principles — Youth Development

- Effective youth development addresses root causes and builds on existing assets.
- Youth are integral parts of networks that include family, school, community and society. So everyone has a stake in youth development, and every institution can find meaningful roles for youth.
- Discrimination in any form limits the realization of young people's potential.

Focal points of their work include:

Youth Development and Governance — The Innovation Center helped launch the *At the Table* initiative in response to a growing national movement to increase youth involvement in community decision-making.

Youth Development and Philanthropy —The involvement of young people in the fund raising process opens up opportunities for youth to learn about and incorporate the philanthropic spirit, while allowing them to claim their rightful place where decisions are made.

Youth Development and Technology —Through projects with partners and communities across the country, the Innovation Center is helping to create resources for using technology as a tool for positive youth development and community development. In addition, the Innovation Center serves as host to an array of e-communities.

Youth Development and Civic Activism—Many young people care deeply about the challenges their communities face and want to work to create positive change. And, some young people find themselves outside the boundaries of prevailing youth development programming and are motivated by the desire to change the societal forces that relegate them to the margins. The Innovation Center is exploring the practical tools for integrating elements of identity and civic activism into youth development practice.

Source: http://www.fourhcouncil.edu/cyd/

Summary of Best Practices of Youth Development

This is but a snapshot of some of the more innovative youth development programs that are developing all across America and is not meant to be exhaustive. Some of the key concepts to keep in mind about best practices of curriculum design, program development for youth in non-formal settings include:

- National 4-H Curriculum Criteria have raised the quality of curriculum products that are now available through national distribution channels like National 4-H Council and the 4-H Cooperative Curriculum System. State curriculum coordinators no longer feel the need to purchase only curriculum materials produced in their state. Therefore it helps if organizations can agree on curriculum criteria.

- Most youth development educators and 4-H volunteers now agree that they should target one or more outcomes or skills. They also seem to agree that life skill development is equally as important as the acquisition of subject matter knowledge and is the basis of deciding WHAT is important for youth to learn. Therefore, organizations need to come to consensus on what is the balance between content and process skills.

- Youth Development educators now agree that teaching experientially is the preferred mode for non-formal education and they are in the process of becoming proficient at designing learning experiences by mapping them along an experiential path. This continues to be an ongoing learning experience, with multiple levels of complexity.

- The late 80's ushered in the *Youth at Risk* movement fueled by research on risk and protective factors. This was counteracted in the early 90's with the youth asset driven model advocated by the Search Institute and has evolved into a *Best Practices of Positive Youth Development Model* that is fueled by a renewed commitment to meaningful youth/adult partnerships, experiential learning and civic activism.

- The new paradigm shift from youth participation for *youth development* to youth—adult partnerships for *community change* (i.e. Community youth development) promises to be a natural evolution of the youth development movement.

This concludes the discussion on the parameters of best practice in 4-H Youth Development. Let's now consider how these best practices relate to accomplishing the goal of boating, fishing and stewardship education.

Best Practices For Boating and Stewardship Education

In the discipline of 4-H Youth Development, topics such as boating, fishing and stewardship relate most directly to programs in Environmental Science. Basically, most of the *Best Practices of Youth Development* as described under Task #1 of this paper are also pertinent to youth environmental education programs in boating, fishing and stewardship education. For example, the National Network for Science and Technology (NNST) has broadened the National 4-H Curriculum Criteria so that it is pertinent to their field of study. Youth—adult partnerships are important regardless of what the topic is, and the *Best Practices for Youth Development* are universal concepts that could be embraced by all. However, here is a more focused look at best practices for youth by looking at it through the lens of Environmental Science programs.

In 1997, the National Network for Science and Technology of the Cooperative Extension Service wrote two significant papers related to science education. They were:

- Science Guidelines for Non-formal Education.
- Nurturing Scientific Literacy Among Youth Through Experientially Based Curriculum Materials.

This network supported collaboration among universities and community-based programs in the Cooperative State Research, Education, and Extension Service (CSREES). The first document, Science Guidelines for Non-formal Education focuses on WHAT to teach and the second on, Nurturing Scientific Literacy emphasized HOW to teach it.

Science Guidelines for Non-formal Education

Science standards have historically set the course for science literacy in the United States for formal K-12 educators. However, little has been done to encourage science efforts out of school. The Science Guidelines for Non-formal Education are developed to help youth educators and volunteer leaders understand the importance of nurturing the skills necessary for a scientifically literate society. Participants in non-formal science education programs, who are able to initiate intelligent discussions about science and technology, are more employable due to their knowledge of science and their ability to use technology. They can also understand science for enjoyment and personal gain (Carlson and Maxa 1997).

Part 1: The Scientific Thinking and Processing Skills
- Observing
- Communicating
- Comparing and measuring
- Ordering
- Categorizing
- Relating
- Inferring
- Applying

Part 2: Eight categories of Content Guidelines
- Scientific inquiry
- Physical science
- Life Science
- Earth & Space Science
- Science and technology
- Science in personal and social perspectives
- History of science
- Unifying concepts and processes in science

Part 3: A teaching model for technology
- Identify problem
- Create a solution
- Test the solution
- Rethink and make changes

Part 4: Leaning and teaching in non-formal settings

- Invention – Knowledge is actively created or invented by youth.
- Reflection – Youth create knowledge through reflection.
- Interpretation – Individual interpretations of the world are reality.
- Social Processing - Learning is a social process that goes on within a culture.
- Sense making – Science is sense making for the individual learner (Driver & Leach, 1993).

The youth driven model asks:
- What do I want to learn?
- How do I want to learn it?
- How do I want to show what I've learned?

The document on *Science Guidelines for Non-formal Education* have thoughtfully outlined WHAT to teach to prepare youth for the workforce as well as providing a vision for scientific literacy for the 21st century. The companion piece to this document entitled *Nurturing Scientific Literacy Among Youth Through Experientially Based Materials* will describe HOW to teach by describing science activities that adhere to these guidelines.

Nurturing Scientific Literacy Among Youth Through Experiential Based Curriculum Materials

In this publication Horton et al (1999) formalizes the process for developing experientially based non-formal science teaching materials. Based on Kolb's (1984) definition of experiential education, the publication demonstrates how all planned learning episodes can be accommodated within an experiential framework. This includes organizing content along an experiential path, identifying instructional methodology and science life skills necessary to teach the content, using an experiential facilitation process to guide the learner gathering the content and delineating post-unit assessment techniques.

Related Environmental Products in the National 4-H Curriculum Collection

4-H Youth Development educators will find that this discussion on scientific literacy overlaps with many of the typical 4-H projects related to Environmental Education and Earth Science, Environmental Stewardship, Earth, Water and Air as well as Plant and Animal Science. Here's a brief review of existing curriculum materials that relate to the boating, fishing and stewardship education.

Environmental Education and Earth Sciences Curriculum Materials

- New Jersey 4-H Science Discovery Series - 1996, Rutgers University

Environmental Stewardship (general)
- Building Common Ground - 1994, National 4-H Council
- Cycling Back to Nature: Food Production and Pesticides - 1995, National 4H Council
- Cycling Back to Nature: Soils Alive - 1995, National 4H Council
- Cycling Back To Nature With Biodegradable Polymers - 1994, National 4H Council
- Mud, Muck and other Wonderful Things - 1995, National 4-H Council

Earth, Water and Air
- Earth Connections - 1992, University of Florida
- 4-H Wetland Wonders - 1998, Oregon State University
- Give Water a Hand - 1996, University of Wisconsin
- Issues Investigation - 1998, 4-H Cooperative Curriculum System
- Soil, Water, and Land Use - University of Florida
- Teen News Network: Groundwater Update - 1993, Michigan State University
- Water Wise Guys - 1992, University of Florida
- Water Education - 1991, Utah State University

Key sources of 4-H Youth Development curricula materials include:
- National 4-H Council Bookstore http://www.4-Hmall.org/ & Source Book.
- 4-H Cooperative Curriculum System (4HCCS) http://www.n4hccs.org/.
- National 4-H Web – Projects: Environmental Education (Note that not all of these materials listed on this web page have passed the national 4-H Curriculum jury.) See http://www.4-h.org/projects/environment/index.html.

Under development by the 4-H Cooperative Curriculum System (4HCCS)
- 4-H Fishing project materials have been pilot tested and introduced at the fall 2000 4-HCCS product premiere and are currently in the production stages.

These fishing materials will be available fall 2001 and could present an excellent opportunity for 4-H Youth Development agents across the nation to partner with the Recreational Boating and Fishing Foundation. As

soon as a copy is available, this author could forward on a preview copy to Recreational, Boating and Fishing Foundation if they are interested in pursuing this partnership.

Summary Best Practices for Environmental Education Programs

Although there is not a wealth of materials on boating, fishing and environmental stewardship available in the National 4-H Curriculum Collections, many states and counties are using materials on a local level that truly work for them. This presents a key opportunity for partnerships to evolve, for the principles outlined for youth development programs in Task One of this paper generally are applicable across environmental education and natural sciences, as will as other fields.

Appropriate Evaluation Methods

One successful evaluation method that the University of Wisconsin Cooperative Extension has used for gauging program effectiveness is the Logic Model. The central questions that this model asks is:

- What difference are we making?
- How will we know it?
- What is the public value of the program?
- Are we doing the right things?

In the mid 1990s, the University of Wisconsin-Extension (UWEX) began using a logic model in response to GPRA (Government Performance and Results Act) requirements and to build a common language for accountability and evaluation across the organization. The UWEX logic model depicts the theory or action of a program in a graphic display that links program investments to program results. The model draws on experience with the USAID Log Frame (~1971) and the Bennett hierarchy of program effectiveness (Bennett, 1982; later with Rockwell, 1995) long a program evaluation tool in Cooperative Extension nationwide.

The Logic Model contains six components with Inputs-Outputs-Outcomes being central to the model:

Situation: the context and need that gives rise to a program or initiative; logic models are built in response to an existing situation.

Inputs: the resources, contributions and investments that are made in response to the situation.

Outputs: the activities, products, methods, and services that reach people and users.

Outcomes: the results and benefits for individuals, groups, agencies, communities and/or systems.

Environment: the surrounding environment in which the program exists, which influences the implementation and success of the initiative, including politics, climate, socio-economic factors, market forces, etc.

Assumptions: the beliefs we have about the program, the participants and the way we expect the program to operate; the principles that guide our work. Faulty assumptions may be the reason we don't achieve the expected outcomes.

Many logic models include *Activities* as a separate element in the *chain of action* and seem not to emphasize participation or reach. This model classifies *Activities* as Outputs where they have also included *Participation*. This has:

- Helped to simplify the model and language.
- Helped focus on outcomes versus outputs.
- Helped to attend equally to the important aspect of who participates, or is reached, which was central to WI programming and diversity goals.

UWEX uses the logic model in program planning as well as in evaluation. They are finding the logic model equally helpful in planning and evaluating group work, teamwork, community-based collaboratives and complex organizational processes in order to promote results-based performance. Such logic models are expanded to include a process *chain of action.*

The UWEX logic model serves as the conceptual framework for the institution-wide Impact Indicator Initiative based in the UWEX Vice-Chancellor's office. A variety of training and professional development offerings are available to help faculty, staff and partners understand and use the logic model. for more information, go to:

uwex/edu/ces/pdande/evaluation/logicmodels.htm

Four Fold Model for Evaluating Curriculum

To strengthen curriculum design and evaluation, Barkman and Machtmes (2000) also urges all youth development professionals to use a common language. Therefore she has used the Logic Model described by Taylor-Powell (1999) to show the flow between inputs, outputs and outcomes and uses this as the evaluation framework for her Four-Fold Model. (http://www.four-h.purdue.edu/fourfold/).

The *Four-Fold Youth Development Model* encompasses the breadth of the youth development field by focusing on the four-fold development of an indi-

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vidual youth: their head, their heart, their hands, and their health. This enables youth to become confident, capable, caring, and responsible citizens. Youth development professionals around the country are using this easy-to-use research based model. The web site (that is currently under development) provides instruments that yield reliable, valid data and a method for data entry. An instantaneous on-line data analysis is generated as well as a printable report. This process makes the Four-Fold Model a very cost effective evaluation tool for youth development professionals who are interested in evaluating specific life skills.

The *Four-Fold Youth Development Model* is based on an extensive search of both theoretical and empirical research. The following databases are utilized for the literature search: ERIC, DAI (Dissertation Abstract Index), PYSCH Index, Social Science Index, and Academic Full Text. The model encompasses 47 youth development skills that youth will need to develop into confident, capable, caring, and responsible citizens. It combines four existing models into one comprehensive model focusing on all four aspects of the individual: their head, their heart, their hands, and their health. The four models included are the *SCANS Workforce Preparation Model, NNST Science Process Skill Model* developed by the National Network for Science and Technology, Iowa State University's *Targeting Life Skills Model*, and the Search Institute's *Internal Asset Model*. This model has encouraged 4-H Youth Development educators to broaden their sometimes-limited view of the 4-H club or project experience to include other educational theories and approaches beyond the simplistic 4-H life skill model.

Barkman et al. (2000) presents a practical way to design and measure the impact of youth development curriculum materials. Evaluation is seen as an integral component of the curriculum design process, not just something that happens at the end. Thiagarajan (1990) suggests that there are two major phases of evaluation: formative and summative. The primary focus in the formative phase is on improving the effectiveness of the curriculum while on the other hand, the focus in summative is on proving that the curriculum achieves its stated performance outcomes. Barkman model includes two basic types of evaluation tools: design team checklists and evaluation checklists. Features that make this Four- Fold Model unique include:

- Inclusion of components, or skill sets, for each individual skill.
- Inclusion of research study abstracts, rather than just a synopsis
- Provision of sample educational activities and curriculum references
- Linkage to File Maker Pro database software package to easily analyze data.

The Four-Fold model web site is already having a tremendous impact on the youth development field. Barkman et al. (1999) hopes that the greatest impact will be to generate a national database with comprehensive indicators that can be used to further research in youth development. This website will then provide program evaluation tools and analysis for all youth practitioners as well as become a database for mining by youth researchers.

Summary of Evaluation Methods

In this section there has been a review of both the Logic Model of evaluation as well as how this has been used as a basis of the Four-Fold Model which was designed to evaluate 4-H Youth Development curriculum. There are probably many other approaches, but these are two major ones that are currently being used in 4-H Youth Development programs

Gaps in Best Practices for Youth Development Education

Missing Curriculum Resources

There are some environmental education materials in the National 4-H Curriculum Collection, as well as five items on water alone, but this is hardly enough to satisfy the needs of over 5 million youth and adults involved nationally in 4-H Youth Development programs. There currently are no boating or fishing curriculum materials in the National 4-H Curriculum Collection, although many 4-H programs are happening at the local level where local partnerships exist. This presents a huge opportunity for collaboration and partnerships between 4-H Youth Development and Recreational Boating and Fishing Association. And as mentioned previously, the 4-H Cooperative Curriculum System has been developing national 4-H fishing materials that will be available fall 2001.

Integrating Research and Practice

Zeldin (2000) noted that, "Over the past decade, research and practice have made almost-independent contributions to our knowledge base about adolescent development." Greater integration is recommended. Experimenting with and building theory through the interplay of research and practice will maximize our knowledge of positive youth development in the community context, while at the same time demonstrating how to promote it. Finally, this will challenge re-

searchers to connect their agendas with those of practitioners, and vice versa. Zeldin (2000) goes on to offer four proposals for integrating research and practice:

- Orient research and practice toward conceptualizing, understanding and achieving positive, community-level outcomes.
- Understand and improve adult attitudes and policy towards youth and their potential.
- Explain and confront the isolation that exists among young people and adults both in community and in community decision-making.
- Marshall all forms of scholarship to prepare nonprofit managers to build capacity for adolescent development.

However, the gap between the researcher and practitioner is still wide even though the Wisconsin 4-H Mission is to integrate research, education and community-based partnerships, enabling youth to learn and practice skills to be productive citizens. (Hutchins 1999) Much work still needs to be done to achieve Wisconsin's vision where 4-H Youth Development is a catalyst for positive community youth development in all Wisconsin counties. However, articulating a vision and mission is the first step toward achieving this lofty goal, and grassroots work is moving along to fuel this movement across the entire state of Wisconsin.

Experiential Learning

The experiential learning theory has been around since John Dewey (1963). Many youth development researchers can talk the talk, but the true masters of the craft of *experiential learning* are often practitioners in the field. That's why many researchers are now involved in action research studies where they actually roll up their sleeves and get involved in local youth development efforts. These research/practitioners have honed their craft to a fine art that often defies traditional quantitative research methods. More qualitative studies need to be conducted to truly describe *the best practices of teaching experientially.*

In 1997 Horton and Hutchinson recommended:

- The development of a valid experientially based science curriculum materials for non-formal education and a call to devise a strategic plan of action for change.
- A concerted effort on the part of 4-H Curriculum specialists nationwide to utilize the recommendations to develop curriculum products.
- Additional research on evaluating experientially based 4-H science curriculum materials from both content and product perspectives.
- Continue to refine the process and instrumentation for determining product reliability during pilot phases of the curriculum development process.

Horton's recommendations were the impetus for the development of the Four-Fold Youth Development series of publications. The first one, 4-H 897 -- Developing Experientially Based 4-H Curriculum Materials focuses on the way in which teaching materials are created, especially the actual arrangement of the parts of the finished product. The second publication, 4-H 898 -- Evaluation 4-H Curriculum through the Design Process, focuses on the pilot testing and data collection phase of curriculum development. It contains both checklists for use by the design teams and evaluation instruments to measure whether the curriculum achieved its stated outcomes.

More research needs to be done to see if the curriculum design model advocated by Horton and Barkman truly does develop experientially based curriculum materials that both provide formative data on how to improve the materials, as well as summative data on providing that the curriculum achieves it stated outcomes. This work is still under development and needs an army of youth development professionals to utilize the on-line evaluation instruments to contribute to the body of knowledge.

Youth—Adult Partnership (Y/AP) Gaps

Camino (2000) notes that current societal forces are again beginning to give greater legitimacy and acceptance to youth – adult partnerships. Camino identifies the following research gaps:

- Practitioners need to be aware of these three dimensions of Y/APs and to gear their research around these concepts of:
  a. Principles and values, which actors use to orient the relationship and to guide behavior.
  b. A set of skills and competencies through which the behaviors are focused.
  c. A method to implement and achieve collective action.
- Researchers should consider how *settings* and *context* figure significantly in the creation of Y/APs. Training alone cannot achieve infusion of Y/AP's without considering both overt and subtle established structures and relationships of power.
- Both youth and adults need consistent access to support as they engage and support Y/APs.

- Researchers need to don different lenses and be willing to challenge established views of adolescents and their potential, as well as investigate the power dynamics that maintain segregation of youth and adults.

Basically, youth development educators have been talking about youth—adult partnerships since the 70's. The theory is in place to advocate such a model, but to successfully support and facilitate such a model is easier said than done. This author has been working with the Wisconsin 4-H Technology Team, as well as with the Dane County 4-H Public Adventures group for the past three years. Based on these personal experiences, she has found that establishing a productive youth – adult partnership is truly an art and demands a high degree of tenacity and hard work, but the lessons learned are well worth the effort! For unless researchers are willing to roll up their sleeves and get involved in the messy business of *real life youth development* and test their theories in the field, the parameters of best practices will never truly advance.

Lack of Research on Community Youth Development

Although the field of Community Development and Youth Development are not new, the merged field of *Community Youth Development* where youth participate to bring about *community change* is indeed very different than youth participation for the sake of *youth development*. Due to the fact that the Community Youth Development framework is relatively new, journal articles and websites are now becoming available. This emerging field holds much promise if funding and research is made available to fill in the gaps between theory and practice.

Influence of Technology on Learning

As technology becomes an integral part of our schools, educators can look to the students — the Net Generation — to help make the shift to more student-centered learning. (Tapscott, 1999) Computers and technology alone is not the answer. The challenge is to learn *how to best use technology* and *the most potent force for change is the students* themselves. Tapscott goes on to identify eight shifts of interactive learning that he has observed in schools across the nation. These eight shifts present real gaps between how many teachers currently teach and how kids ideally learn best. His eight shifts of Interactive Learning include:

- From linear to hypermedia learning — Most textbooks are written to be tackled from beginning to end. Youth today access information more interactively and non-sequentially as they surf channels and multi-task between many different software programs and websites.
- From instruction to construction & discovery — Rather than standing up in front of a group and *teaching* something, educators should design curriculum in partnership with learners or even help learners design the curriculum themselves. Constructivists argue that people learn best by doing, rather than just listening, especially if they can construct knowledge anew, based on their concrete experience with abstract ideas and concepts.
- From teacher-centered to learner centered education — Teachers need to focus on creating the learning environment and providing resources.
- From absorbing material to learning how to navigate and how to learn — This means learning how to synthesize, not just analyze information so youth can construct higher-level structures and mental images.
- From schools to lifelong learning — Learning has become a continuous, lifelong process and really just begins after getting a formal degree or certificate.
- From one-size fits all to customized learning — Digital media could allow every individual to find personal paths to learning based on their backgrounds, talents and learning styles.
- From learning as torture to learning as fun — Using the new media, the learner becomes the entertainer and is motivated, feeling responsible for learning.
- From the teacher as transmitter to the teacher as facilitator — Teachers need to act as consultants to teams of youth, facilitating the learning process by helping youth process the experience, as well as participating as a technical consultant on new media.

Tapscott closes his article by stating, "Give students the tools, and they will be the single most important source of guidance on how to make their schools relevant and effective places to learn." His view indeed complements those of innovative youth development educators who are also advocating strong youth – adult partnerships based on experiential learning experiences. An astute group leader who can construct learning activities as well as help the group process and apply what was learned in a different setting needs to facilitate this new type of learning. Most non-formal educators, like those in Extension, can do this more effectively for they are not burdened by the structure of the formal classroom and the need to implement state mandated education standards, assessment and accountability measures.

Evaluation Gaps

There has been a lot of formative evaluation, describing how to improve programs and curriculum products, but there's never enough good summative evaluation on whether a program or a curriculum has really made a difference. Although the Logic Model appears to hold the most promise, the jury is still out on whether it can truly answer these key questions:

- Did we really make a difference in the lives of people?
- Do the Curriculum products really work and support the intended outcomes?

There has never been a *silver bullet* that has been able to satisfy the unquenchable need to document the difference programs have made. However, at this time in history in the field of 4-H Youth Development, the Logic Model shows the best potential of meeting this need. However, more research needs to be aggregated to show if it truly delivers on its promise.

Summary of Gaps in Best Practices

In summary there is a need for more research on:

- Defining and developing quality boating & fishing curriculum based on national criteria for non-formal community based organizations like 4-H.
- The integration of research and practice to clearly articulating the *best practices* for facilitating youth—adult partnerships for:
  a) Facilitating meaningful experiential learning
  b) Creating a community youth development model for creating change
  c) Interactive learning utilizing technology
- Determining if the Logic model has been able to help programs show that they truly have made a difference in the lives of people.

Recommendations for Future Research

Recommendation #1: Integrating Research and Practice

Researchers need to utilize Youth–Adult Partnerships with youth fully engaged with adults in research related activities to define best practices focused on:

- Implementing youth—adult partnerships in diverse communities.
- Engaging community based youth—adult partnerships in creating their own experiential based curriculum.
- Implementing interactive technology based learning in community organizations.
- Defining strategies for moving from a positive youth development model to a community youth development framework that harnesses the energy, creativity and dedication of both youth and adults to create community change
- Developing an international version of this emerging community youth development framework that could be adaptable around the world.

Each of these five recommendations is an in-depth research proposal of its' own and could require the intensive work of a cadre of researchers for many years to come. However, it is often easier to look around one's environment and begin to try things out on a small scale, working on this in a more holistic and integrative fashion.

One example of this approach is the work this author is currently doing with the Wisconsin Department of Instruction's Digital Divide grant helping rural Wisconsin communities train youth to increase community access to technology. To integrate research and practice, we are proposing to work with existing youth—adult partnerships and use the Logic Model to develop a performance framework to clearly communicate the inputs, outputs and outcomes of this grant, in language that is understood by all partners. We hope to engage youth–adult partnerships in six locations to create their own experiential based curriculum and to implement interactive technology based learning. Our ultimate goal is that this process will help move communities from a positive youth development model to a community youth development focus whose long term outcome is to create intentional sustainable social change that decreases the digital divide in rural communities.

To initiate this process we will be proposing that the evaluation work group of the Digital Divide Steering Committee be comprised of an equal number of youth and adults. They could participate in a one-day workshop where they use the Logic framework to clearly articulate the outcomes of this grant, in common language that can be understood by all stakeholders. This Logic Framework approach could also be used with other potential sites that hope to receive subgrants. Workshops on utilizing youth and adult partnerships to co-create their curriculum would follow, along with ongoing support for sustaining this community youth development model for decreasing the digital divide in six rural communities.

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Recommendation #2: Relationship to Youth Environmental Education Movement

Although I am not able to speak to eloquently to the area of boating, fishing and environmental stewardship, I can only assume that the same principles would be relevant to this field. One example of how to approach this could include the following scenario.

- Non-profit organizations like RBFF could work with youth development researchers and practitioners to create a sustainable grassroots movement mobilizing youth and adult partners to conserve and restore our nation's aquatic natural resources by getting involved in boating and fishing. One way they could get started would be to:

- Develop a long term sustainable Youth – Adult Boating and Fishing Stakeholder group comprised of 50% youth and 50% adults that would provide ongoing strategic direction. They could use the logic framework to help determine what is the best way to build these types of youth – adult partnerships on both a national as well as grassroots level.
- Provide youth—adult partnerships with tools to develop a marketing campaign to help middle school youth conserve and restore our nation's aquatic resources through involvement in hands on water, fishing and boating service activities.
- Once these youth—adult partnerships are established, involve them in co-creating experiential based fishing, boating and environmental stewardship curriculum materials that can be customized for use with other local youth—adult partnerships.
- Provide these curriculum materials in both print and interactive technology based options that can be customized for use by end users.
- Use technology to help strengthen and create a sense of community among grassroots organizations and real people with an interest in these topics.

These are but a few ways that these Best Practices of Youth Development could relate to the Recreation Foundation for Boating and Fishing (RBFF). But like any other sustainable community development effort this approach needs to be designed by the real people who are the key stakeholders in the RBFF movement. For often times the process of co-creating movements like this is even more important the ultimate product.

Summary and Comments

While reflecting on the historical evolution of 4-H Youth Development movement or the environmental movement one must remain true to one's core values and learn from the past. In closing, I urge Recreational Boating and Fishing Foundation to continue to utilize marketing and education strategies on their journey to increase public awareness for protecting, conserving and restoring this nations' aquatic natural resources. This lofty goal could lend itself to integrate research and practice by using youth—adult partnerships, experiential learning strategies and the community youth development movement to continue to develop a sustainable learning community that helps bring about lasting change in how communities approach boating, fishing as well as environmental stewardship.

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BEST PRACTICES IN MARINE AND COASTAL SCIENCE EDUCATION: LESSONS LEARNED FROM A NATIONAL ESTUARINE RESEARCH RESERVE

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Abstract – The Jacques Cousteau National Estuarine Research Reserve (JC NERR) program has successfully capitalized on human interest and fascination with the ocean by using the marine environment as an entry point to develop interest and capability in understanding science. This natural interest can be used as a springboard to encourage educators and their students to use the marine environment as a focal point while developing basic skills in reading, writing, math, problem-solving, and critical thinking. The Institute of Marine & Coastal Sciences (IMCS), as the managing agency of the JC NERR has remained committed to making its faculty, staff resources and advanced technology available to educators and their students. With the selection of model science programs and the development of collaborative school projects and Internet connections, IMCS strives to make science education more exciting and relevant to current environmental policy issues. With this approach, educators can short circuit the arduous rote memorization exercises commonly associated with the study of science, and replace it with first-hand experiences found within the scientific and cultural resources of New Jersey. By encouraging scientists and educators to work together to spark interesting and meaningful science learning in the classroom, NJ students become better prepared not only as potential scientists, but as informed decision-makers and citizens as well.

The JC NERR K-12 education program is designed to empower classroom teachers and the school community to become facilitators of scientific learning based in an interdisciplinary context. JC NERR education programs are designed to:

1. Build knowledge and skills by providing classroom teachers with basic ecological knowledge and the skills necessary to foster interesting and meaningful learning grounded in science.
2. Evaluate attitudes through the program's ability to:
   - Foster intellectual interest and self-confidence
   - Develop an understanding of nature and a sense of curiosity
   - Enable individuals to perceive the environment in a more realistic way and with greater awareness and commitment.

Introduction

The Jacques Cousteau National Estuarine Research Reserve (JC NERR) is part of a network of protected areas established to improve the health of the nation's estuaries and coastal habitats by developing and providing information that promotes informed resource management. The Reserve provides research and education opportunities and practical information for a wide variety of audiences, from "kindergarten to senior citizens" including K-12 educators, students, local/state government, families, resource users, tourists, elder hostel, etc. The NERR system is a system of sites that serve as living laboratories where scientists, educators, and coastal managers work together to improve land use management and decision-making/policy-making in the coastal zone.

The JC NERR is composed of public lands held by various state and federal entities. Encompassing just over 110,665 acres of terrestrial, wetland, and aquatic habitats, the Mullica River-Great Bay Estuary is regarded as one of the least disturbed estuaries in the densely populated urban corridor of the Northeastern United States. The Reserve is an excellent site to provide a long-term database for valuable management of coastal resources.

Research and education programs enhance public understanding of how the Mullica River-Great Bay estuary functions and help to preserve the area for future generations of users. The Jacques Cousteau Coastal Education Center, located in Tuckerton, NJ serves as the hub for outreach and education programs associated with the JC NERR. This state-of-the-art facility is managed by the Institute of Marine & Coastal Sciences

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(IMCS) at Rutgers University, and is designed to serve primarily adult learners, including K-12 educators and coastal decision-makers (defined as those who during the course of their professional responsibilities make decisions that affect the coastal zone). This paper will focus on our collective years of experience searching for Best Practices in curricula, programs, and leadership in marine and coastal education/interpretation with respect to the Reserve's principal target audiences of K-12 educators and coastal decision-makers.

Parameters for Best Practices in K-12 Marine & Coastal Science Education

For the past six years, the JC NERR program has successfully capitalized on human interest and fascination with the ocean by using the marine environment as an entry point to develop interest and capability in understanding science. This natural interest can be used as a springboard to encourage educators and their students to use the marine environment as a focal point while developing basic skills in reading, writing, math, problem-solving, and critical thinking. IMCS has remained committed to making its faculty, staff resources and advanced technology available to educators and their students. With the selection of model science programs and the development of collaborative school projects and Internet connections, IMCS strives to make science education more exciting and relevant to current environmental policy issues. With this approach, educators can short circuit the arduous rote memorization exercises commonly associated with the study of science, and replace it with first-hand experiences found within the scientific and cultural resources of New Jersey. By encouraging scientists and educators to work together to spark interesting and meaningful science learning in the classroom, NJ students become better prepared not only as potential scientists, but as informed decision-makers and citizens as well.

The JC NERR K-12 education program is designed to empower classroom teachers and the school community to become facilitators of scientific learning based in an interdisciplinary context. JC NERR education programs are designed to:

3. Build knowledge and skills by providing classroom teachers with basic ecological knowledge and the skills necessary to foster interesting and meaningful learning grounded in science.
4. Evaluate attitudes through the program's ability to:

- Foster intellectual interest and self-confidence
- Develop an understanding of nature and a sense of curiosity
- Enable individuals to perceive the environment in a more realistic way and with greater awareness and commitment

Parameters for Best Practices in K-12 Marine Education

The goal of the JC NERR is to design and implement a collection of education programs that instills the skills necessary to analyze and resolve questions and issues while gaining new knowledge. JC NERR education programs are focused on the educator as the principal facilitator of knowledge in the classroom. Since 1994, the JC NERR has offered professional development opportunities for K-12 educators that incorporate best practices in curriculum design, implementation, and assessment.

The JC NERR education program seeks to *bring the ocean into the classroom* in support of basic skills training, problem solving, and critical thinking. The establishment of JC NERR education programs in New Jersey public schools is designed to promote investigative, inquiry-based science education and to improve the overall quality of science education in NJ public schools. The principal focus of the program is to provide NJ educators with an interdisciplinary marine science program that can be easily and effectively implemented into the classroom. Our objective is to create a cadre of educators who can bring information back to their home schools and support the involvement of the whole school in the program.

The JC NERR has developed an integrated set of educational programs that capitalize on the research and technological assets of the Reserve and its host, the Institute of Marine & Coastal Sciences at Rutgers University, as the nucleus for interdisciplinary learning across grade levels. Through associations with the Reserve program and partners such as the Lawrence Hall of Science, the National Marine Educators Association, Stevens Institute of Technology and Virginia Institute of Marine Science, the JC NERR has attempted to develop innovative concepts for teaching science and forge strong partnerships with K-12 educators. These programs and partnerships have facilitated the integration of research into high-quality professional development programs and educational materials. The Reserve has utilized the following criteria and best practices in designing and conducting K-12 educational programs:

Immerse the whole school in learning.

Teachers may work together in the same building for years but may only have sketchy knowledge of

what is going on in each other's classrooms. Elementary, middle and high schools alike can be nurturing environments, but fundamentally a collection of one-room schoolhouses (Jacobs 1997). With a whole school approach, administrators and classroom educators can coordinate a cohesive plan of study, matching current assessments with all levels of state standards, and generating quality communication among staff and administration that can help renew the curriculum (Jacobs 1997).

JC NERR programs are focused on an entire school building, across grade levels and including all professional faculty and staff. Leadership Teams of teachers within the school community are created to serve as liaisons between the JC NERR and the school. The Leadership Team serves as peer trainers and facilitators of the program within the school building. The JC NERR also tries to establish strong connections with the school administration, who are often responsible for introducing innovations and who must support team teaching initiatives.

Provide sustainable professional development training and resources supported by the science community

Professional development and training efforts must be sustainable and supported by scientists. Teachers must be exposed to the process of scientific inquiry, not just the end products of research that have taken years to trickle down into textbooks. An inordinate focus on science content only reinforces the inadequacy many teachers already feel about their own science content knowledge. According to Bowers (1996), the lack of knowledge of science content as the primary reason that teachers do not teacher science well is a myth. When the focus is switched from content to process, the hesitation of teachers to teach science is greatly diminished.

The scientific community has a responsibility to provide resources to teachers and assist schools with seeking outside funding for science education (Heinmand 1995). Scientists should provide mentoring and coaching to enhance the capabilities of schools to be the interface between science and society. JC NERR education programs strive to provide educators with access to real-time scientific data and resources to strengthen inquiry-based learning.

The JC NERR has made a strong effort to provide educators with quality materials developed without bias from industry or environmental advocates. Environmental education has come a long way from the Earth Day celebration of the 1970's. Thirty states now require or strongly encourage environmental lessons as part of the public school curriculum. There is overwhelming support from the school community including parents, students and educators/administrators to utilize environmental education in schools. A 1997 survey for the National Environmental Education and Training Foundation found that 95% of all respondents strongly supported environment based education. However, officials of the North American Association of Environmental Educators concede that mandates for environmental education often do not include guidelines or a budget. Teachers end up relying on free materials from corporations or environmental advocacy groups sometimes laced with environmental or pro industry agendas. The JC NERR has felt a responsibility to provide quality classroom materials as part of its professional development programs.

The JC NERR has made an extra effort in special needs schools in an attempt to fill gaps in current knowledge and improve access to scientific information. Research indicates there is widespread lack of access to science and mathematical resources in urban inner city schools. Tobias (1992) writes, "High ability students at low socioeconomic status high-minority schools may actually have fewer opportunities then low ability students who attend more advantaged schools." Research indicates that young people from disadvantaged areas are often exposed to greater environmental hazards than children from other areas, making the knowledge and critical thinking skills associated with such a program even more valuable. Finally, disadvantaged youth have fewer opportunities and incentives to experience the natural world. The Reserve has collaborated with local government, non-profits, and community organizations to improve urban school access to scientific resources.

Utilized Effective Educational Practices

Scientists and staff of IMCS spent a number of years researching and identifying model education programs that would represent the educational goals and objectives of the Reserve program. Years of research and association with our partners principally including the Lawrence Hall of Science at the University of California at Berkeley and Stevens Institute of Technology in Hoboken, NJ has allowed IMCS to develop pedagogical approaches based on best practices.

JC NERR education programs strive to be learner-centered and have a constructivist paradigm that adapts to the needs and interests of the students. Teachers become facilitators, enabling students to use active techniques, such as experimentation and real-world problem solving to create knowledge. The students' newly

created knowledge is based on asking questions, exploring, and assessing what they already know (Brooks 1993, 1999). Constructivism transforms the student from a passive receiver of knowledge to active participant in the learning process. Students are stimulated and engaged in learning because learning activities are grounded in an authentic, real-world context. Students use their natural curiosity of the marine environment as an intrinsic motivator to improve their thinking and communication skills.

The JC NERR develops classroom materials in partnership with scientists and educators to promote the development of problem-solving skills, the conduct of systematic observations, the interpretation and analysis of information, the drawing of conclusions, and the communication of results. Inquiry-based learning using hands-on and minds-on activities produce high quality learning experiences in both the classroom and field. *In Science for All Americans* (AAAS, 1990), a number of effective science teaching principles are presented which illustrate that teaching should be consistent with the nature of scientific inquiry. Understanding the process by which scientific knowledge is acquired is just as important as what is learned. Educators should be provided with access to current scientific information and technology and equipped to present science in an active learning environment where the learning process becomes more important than the memorization of facts and figures.

The JC NERR recognizes the need for innovative materials that provide teachers with the knowledge and skills they need to help their students work toward science literacy. Bowers (1996) states there is a perceived need for inquiry-based materials for the 6-12 grade levels. Over the past several years, numerous companies have begun marketing excellent early science (K-5) curriculum. However, beyond the elementary school level there is no outstanding, readily available inquiry-based curriculum (AAAS Report: Heavy Books Light on Learning 2000). Many middle and high school textbooks cover too many topics and do not develop them well. Current higher-grade level materials are lecture based with cookbook laboratory exercises that do not help students relate what they are doing in class to underlying ideas. IMCS has responded to a perceived need of inquiry-based activities that utilize real-time data in the classroom and focus on current oceanographic research.

The Reserve has developed a number of educational programs that take advantage of the benefits of collaborative learning. Collaborative learning may be defined as a method of teaching and learning in which students team together to explore a significant question or create a meaningful project (Johnson 1991: Weber 1999). Students become actively involved in content, take ownership of their own learning, and learn to resolve group conflicts and improve teamwork skills by working on cooperative projects. The Reserve has found that a particularly compelling use of cooperative learning involves the use of the Internet. With the Internet, collaboration can occur regardless of barriers to distance or time. The Internet also provides access to real-time scientific data and collaborative opportunities with scientists and other classroom experts.

Materials either adopted or developed by the JC NERR encourage educators to create opportunities for authentic learning based on students' interests, needs, and talents. Educators are encouraged to define their students' intelligence more broadly by subscribing to the Triarchic Theory of Intelligence, developed by Professor Robert Sternburg of Harvard (1985). This theory states that all humans have multiple intelligences, including analytical, practical, and creative intelligence. Using this theory, educators can use visual arts, music, and dance as well as science and math as valuable tools to improve students' understanding of the real world.

Use the environment as an integrating context across disciplines and subject matter

Peer reviewed research has shown that the interdisciplinary integration of subject matter can serve to break down traditional boundaries between disciplines. Over the past several years the interest in curriculum integration has intensified. Proponents point out that knowledge in all areas of study is growing exponentially. In the sciences, for example, research and practice has created a remarkable body of knowledge. Each area of the curriculum has the blessing and burden of growth (Jacobs 1989).

By using the Environment as an Integrating Context (EIC) for learning, schools can improve their ability to provide interdisciplinary, collaborative, student-centered, hands-on, and engaging learning environments for their students (Lieberman and Hoody 1998). EIC-based learning is more than just increasing environmental awareness; EIC uses the school's surrounding area and community to allow students to construct their own learning, guided by teachers using proven educational practices.

A study completed by the State Education and Environment Roundtable indicates 92 % of students in EIC programs outperform their peers in traditional programs (Lieberman and Hoody 1998). Evaluation results from administrators and educators involved in ocean

education programs indicate that children are naturally fascinated with the ocean and this content focus in the classroom can improve students' acquisition of basic skills including language arts and math.

Use evaluation strategies as part of a continuous effort to revise and improve the science program

The JC NERR has assessed and evaluated its program teaching strategies to determine if they support the intended learning goals and objectives of the Reserve program. This type of inward reflection provides useful data that allows the JC NERR to develop more effective education programs and resources. JC NERR education staff has gathered information and data using surveys and focus groups on the educator's knowledge and attitudes regarding marine science education. This *Front End* evaluation, or needs assessment, allows for the collection of information critical to planning an effective education program.

The Reserve also engages in *Formative* evaluations, which involve a continuous stream of reflection and feedback, allowing the educator and student to make mid course corrections in their work as it is ongoing. The more traditional *Summative* evaluations focus on the collection of feedback after instruction has been completed (Parsons 1997; Wiggins 1998).

Involve the community in K-12 science education

Many studies have indicated that parental and community involvement in schools improves student learning. Community members and parents can act as role models and mentors and most importantly serve and an additional layer of support for the classroom educator. The Reserve has been successful in using family science and whole school events such as Ocean Week/Month to generate interest and support from the community for the school's science program.

Use the Internet as a collaborative tool for compelling learning opportunities

It is estimated that in 1850 it took about 50 years to double the world's knowledge base, while today the same feat takes little more than a year. Never before have we had as much information at our disposal as we do now, including the ability to communicate information instantaneously with audiences around the globe. A decade ago found much of the education community heralding computers and the Internet as the next panacea for K-12 learning and education reform efforts. Hopes ran high that increased access to information, made possible by rapidly improving technologies, would result in a new learning paradigm in which students would assume more responsibility for their own learning. Students would use technology to develop the skills to locate, organize, analyze, and convey information themselves, rather than absorbing an established body of knowledge. Yet today, with technology faster and more available than ever, the effectiveness of this tool in the classroom remains a source of great debate.

Americans are investing billions of dollars at local, state, and national levels to bring computer technologies to our schools. The education community generally agrees that technology can only be effective in the educational arena if a "human infrastructure" exists to guide its application. Technology serves as an educational tool, and its usefulness is determined by the quality of the curriculum content and instructional strategy it helps to employ. In light of this, educational issues such as curriculum reform, professional development, assessment, and equity must be addressed as they relate to technology.

Efforts have been made by a number of organizations to use technology to bring ocean sciences education into the K-12 classroom. The innate human fascination with the ocean, coupled with the interdisciplinary nature of the ocean sciences and accessibility of ocean data, creates an excellent opportunity for incorporating technology into the learning experience. The Internet provides the ability to greatly increase (1) communication and collaboration among students and teacher, (2) the range of resources available to students, and (3) opportunities for students and educators to present their ideas and opinions.

Model Programs in K-12 Marine Education

There are many ocean science education programs worthy of mention, in a review of *Best Practices* such as this. The National Marine Educators Association (NMEA), which is affiliated with the National Science Teachers Association and the American Association for the Advancement of Science, provides a valuable focus for marine and aquatic studies world-wide. There are a number of well-planned efforts at coordinating Ocean Science education activities. For example, the Bridge (http://www.vims.edu/bridge/) catalogs a selection of the best online resources for marine science education. Developed by Dr. Lee Larkin and Vicki Clarke at the Virginia Institute of Marine Science (VIMS), this on-line resource catalogs marine science resources available to K-12 teachers.

The "Consortium for Oceanographic Activities for Students and Teachers," or COAST, (http://coastnopp.org/index.html) is a working collaboration, led by

Dr. Sharon Walker, designed to effectively deliver oceanographic and coastal process education to pre- and in-service teachers from kindergarten through the twelfth grade (K-12). Project Oceanography (http://www.marine.usf.edu/pjocean/index.html), created by Dr. Paula Coble from the University of South Florida, is a live cable television program designed for middle school science students. Each week during the school year, students learn about a variety of ocean science topics taught by real scientists and delivered to the classroom via cable TV. The JC NERR is involved in a nationally coordinated program called Marine Activities Resources & Education (MARE) that focuses on whole school engagement in interdisciplinary hands-on lessons.

Marine Activities Resources & Education (MARE): A Model Program

MARE, which was developed by the Lawrence Hall of Science at the University of California at Berkeley, is an interdisciplinary, whole school program that engages teachers, students, parents, administrators, and the community to transform elementary and middle schools into dynamic laboratories for the study of the ocean. The program, created in 1991, has been successfully implemented at over 250 inland and coastal schools in five states including California, Texas, Colorado, Michigan, and Oregon. MARE is especially designed to improve science instruction for all students while promoting equity, language acquisition, environmental awareness, and academic excellence. MARE was selected as one of the 50 most Promising Science and Math Programs in the U.S. and as a Best Practice by ten Regional Eisenhower consortia funded by the U.S. Department of Education Office of Educational Research and Improvement.

The MARE curriculum associates each grade level with a different marine habitat. Crossing disciplines, and linking subject areas, this curriculum helps students understand the overarching principles of science. The curriculum is aligned with and supports Project 2061 Benchmarks for Science Literacy and the NRC National Science Standards for Science Education. Grades K-3 study shoreline habitats that are more familiar to younger students (K-1: rocky seashore; grade 2: sandy beaches; and grade 3: wetlands). Grades 4-5 study offshore habitats that are generally less familiar and represent more abstract processes (grade 4: kelp forest, grade 5: open ocean). Middle schools study even more remote habitats that are of global ecological significance (grade 6: islands, grade 7: coral reefs, and grade 8: polar seas). At each grade, the MARE habitat curriculum provides a minimum of 10 weeks of inquiry-based, hands-on activities, covering an integrated treatment of earth & physical science (substrates, properties of water, currents, tides, weather, seasonality, etc.), environmental issues (human dependence on the ocean, resource use, pollution, habitat loss, etc), mathematics, language, arts/literature, social studies, art, music, and drama.

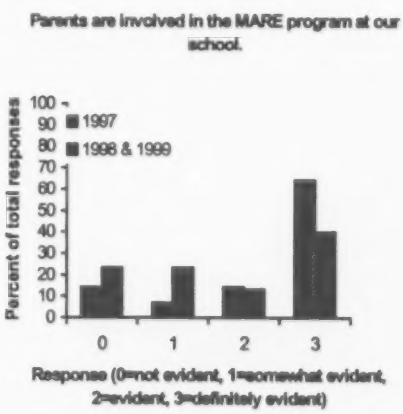
Individual teachers at MARE schools use the thematic curriculum at their own pace throughout the year as a vehicle for coordinating and weaving together all of their science instruction. Each school chooses one portion of the year, however, when the whole school can work together intensively in an immersion style event, called Ocean Week (Ocean Month in subsequent years). Ocean Week transforms an entire school into a laboratory for the discovery and exploration of the ocean. During Ocean Week, teachers devote 100 % of their instructional time to integrated ocean studies. Students take field trips and work together on special class, cross grade and whole school projects. Expert guest speakers visit the school. Parents flood in to observe the excitement and end up helping in new and unprecedented ways. Janitors, school secretaries, art teachers, and cafeteria crew all suddenly become science teachers because of their experiences and special perspectives. Ocean Week can be characterized as a positive disruption at schools, an event that overcomes the normal constraints faced by teachers.

Over the last several years, the New Jersey MARE program has trained hundreds of elementary school teachers from 27 schools (9 school districts). IMCS has worked with a range of urban, suburban, and rural schools from across the state. Over 10,000 students will be involved in the MARE program this year. The success of the program appears to be a professional development tining model that is entertaining, educational, and practical. Each summer, a team of educators, scientists, and peer trainers conduct a weeklong Summer Institute where educators are treated to scientific lectures, classroom demonstrations, and field trips.

Upon evaluating MARE with focus groups, surveys, and other evaluation tools, the participants attribute the success of the program to the "*peer teaching*" format, the help and guidance of IMCS staff during the program and throughout the school year, and the high quality classroom materials provided. Summer Institute participants cited benefits such as addition of exceptional lesson plans, increased knowledge of marine and coastal sciences, confidence in the classroom (answering questions, choosing experiments, etc.), and the ability to share knowledge and ideas with other teachers. Other benefits included access to current information on the environment and new scientific trends, and increased awareness of potential careers for their stu-

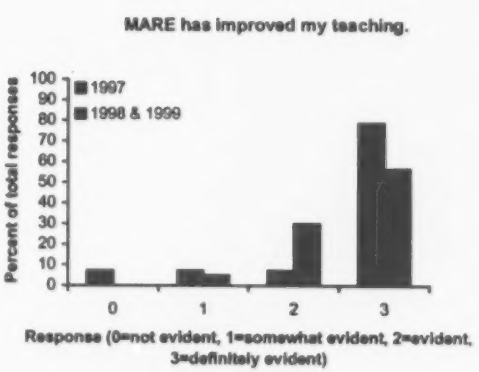
dents. Participants also reported that the MARE program increased parent involvement in the science program.

MARE staffs at IMCS and the Lawrence Hall of Science feel strongly that this program is a successful example of how scientists and educators can work together to spark interest and meaningful learning in the classroom. The MARE program short circuits the arduous rote memorization of traditional test books and allows teachers to experience first hand the scientific and cultural resources of New Jersey and translate that experience to the classroom. Through MARE, these experiences are made available to New Jersey students, some of whom will become tomorrow's scientists and engineers, and all of whom will be challenged to make informed decisions on future environmental issues.



Participants report that the MARE program encourages parents to be involved in Ocean Week. Community members are invited to the school to assist with lessons, read ocean-related literature to students, and participate in field trips.

> "Parents report kids have an increased interest in science as a result of Ocean Week."
>
> 4th Grade Teacher
> Little Brook Elementary School
> Princeton, NJ



The Coastal Ocean Observation Laboratory (COOL ROOM)

IMCS has developed a series of Internet-based, instructional modules that link classrooms with active research investigations at the Coastal Ocean Observation Laboratory (COOL) and the Long-term Ecosystem Observatory (LEO). Scientists have set up several data collection systems that monitor the coastal waters year-round to help them learn and understand more about the underwater coastal zone of New Jersey. The first of these systems was the Long-term Ecosystem Observatory, or LEO. Located just 10 km offshore in 15 meters of water, LEO consists of two underwater nodes linked via an electro-optic cable to the Rutgers University Marine Field Station in Tuckerton, NJ. LEO has the ability to instantaneously deliver data such as information on water temperature, salinity, visibility, wave height, wave period, chlorophyll (phytoplankton) content, and current speeds and directions from the ocean depths to the classroom via the Internet. These measurements, taken in the water, are complemented by satellite data received at IMCS, which tells scientists about sea surface temperature, water quality and phytoplankton content over a 40 degree latitude x 50 degree Longitude area.

Scientific data is posted on an Internet website (www.thecoolroom.org) for use by scientists, resource users, educators, and students. The COOLroom is the first of its kind in the world and is expected to be one in a series of nodes created along the East Coast of the United States. From the LEO data, scientists will be able to make physical and biological forecasts. The US Navy is using the information they learn from LEO to improve their ability to predict what type of ocean weather S.E.A.L.'s may encounter during military operations. CODAR, or Coastal Ocean Radar, can be

erations. CODAR, or Coastal Ocean Radar, can be used to predict surface ocean current direction, which is useful to the U.S. Coast Guard in search and rescue efforts. Optical sensors may allow scientists to predict red tides, which are the sudden bloom of a kind of microscopic organism that can kill marine creatures and injure humans.

Instructional modules prepared for middle and high school (6-12 grade) level students focus on development of critical thinking and analytical skills and utilize student fascination with the ocean. In collaboration with Stevens Institute of Technology and with the support of the National Ocean Partnership Program (NOPP), the modules were developed with input from scientists, technicians, school administrators, and educators. Each module was written in support of the National Science Education Standards, addressing fundamental abilities in scientific inquiry, life sciences, population and ecosystems, and earth and space sciences. Internet topics range from the technology associated with an undersea observatory, effects of wind on water motion, relationship between weather and ocean circulation, physical characteristics of the Gulf Stream that can be measured and interpreted with remote sensing imagery, and oceanographic processes such as upwelling.

The instructional modules are journal-based and require analytical skills to synthesize and display time-series information. Each module permits students to access real-time data at LEO and explore data applications. Students participate in the same predictive process used by IMCS oceanographers. One of the more popular modules encourages students to predict a "good beach day" by using LEO data. Students learn about coastal upwelling, the winds which blow from the southwest along the New Jersey coast causing NJ coastal water to be cold and turbid on the warmest days of the year.

Best Practices: Summary

Programs like MARE, Project Oceanography, and COAST are bringing positive change to their learning environments through well-planned professional development programs, and the development of exceptional classroom resources. However, the Ocean Sciences lack a coordinated national effort in education. This problem is soon to be remedied through the establishment of a Center for Ocean Sciences Education Excellence (COSEE). This effort will be led by the National Science Foundation and will establish a nationally coordinated program for Ocean Science education in both formal and informal education sectors (McManus et al. May 2000).

Parameters for Best Practices in Technical Training for Coastal Decision-Makers

One of the major thrusts of the JC NERR program is to develop and provide information for better resource management. Community leaders, resource users, planners, regulators and resource managers make decisions each day that affect land use and the use of coastal resources. Difficult decisions are routinely made with insufficient information. In 1988, the Rookery Bay National Estuarine Research Reserve in Naples, Florida implemented its first coastal decision-maker workshop, targeting environmental professionals. The Rookery Bay workshop became the model for the Reserve System's Coastal Decision-Maker Workshop series. These workshops now serve as the backbone of a suite of technical training opportunities offered through the Coastal Training Institute initiative currently being developed in all 25 Reserves in the NERR system.

JC NERR staff conducts a variety of technical workshops on regional coastal management issues directed toward local government officials and other decision-makers. These workshops and programs foster a community-based approach to environmental stewardship and informed decision-making by marshaling the best available scientific information and best management practices for application in land use management decisions. The Reserve has utilized the following criteria and best practices in designing and conducting coastal decision-maker programs.

Understand the Audience Need

Community leaders including planners, resource managers, and regulators are very busy, and almost always need information quickly to meet the demands of their jobs. Often these positions have high turnover. It is important to assess the informational needs of the audience and understand the attitudes and professional culture. Assessing the audience's informational needs ensures efficient and targeted training.

Design and Implement Effective Training Workshops

The NERRS program is working to develop an effective model for coastal decision-maker workshops (Allen *per communication*). Essential elements of an effective workshop include 1) clearly defined educational goals and objectives, 2) materials that accommodate different learning styles, 3) the use of field trips and/or small/large group discussion to enhance learning, 4) selection of dynamic and knowledgeable speakers, and 5) good logistical planning (refreshments, facilities, etc.). NERRS educators also report that pro-

viding incentives to participants in the form of continuing education credits or certificates can often increase participation in the workshop. Participants value and appreciate time built into the agenda for professional networking.

A good facilitator is invaluable in assuring that the workshop stays on the published schedule and contentious issues/discussions are handled efficiently and equitably. The NERRS program also has noted the importance of developing appropriate hand-outs and follow up materials that are readily available. This may include language translations as the audience need is defined.

Develop technical tools to improve data delivery to coastal decision-makers

A major goal of the NERR is to offer sustainable technical support coupled with professional training to the coastal management community. The Reserves are working to develop Geographic Information Systems (GIS) visual resources (maps) that will allow coastal decision-makers to visualize scientific data including water quality, land use patterns, and the location of sensitive habitats in Reserve communities. These tools will promote the partnerships necessary to exact long-term improvements in land use decisions.

Best Practices in Technical Training for Coastal Decision Makers

The Coastal Decision-Maker Workshops, which are offered in all 25 National Estuarine Research Reserves in the U.S., teach coastal decision-makers about applied and theoretical coastal management issues, including improvements to water quality, habitat restoration and mapping technologies. The close connection between research activities, ecological monitoring and education in the Reserve System ensures the dissemination of timely information to workshop participants. The location of most reserve facilities (adjacent to their respective estuaries) provides participants both classroom and hands-on field experience. For example, Old Woman Creek National Estuarine Research Reserve is actively involved with local landowners and resource managers in precision farming and stream bank stabilization projects to reduce non-point source pollution. In Florida, Rookery Bay National Estuarine Research Reserve staff received support from the Florida Coastal Management Program to develop a watershed restoration and management plan for local, state and federal agencies. In North Carolina, Reserve staff is pioneering new streaming video technology to deliver technical information via the Internet to the desktops of coastal managers. This media allows scientists, coastal managers, and educators to collaborate, brainstorm, and learn through the convenience of their desktop.

The JC NERR initiated its Coastal Decision-Maker Workshop series in the spring of 1999 and has provided a broad range of technical training programs to a local coastal management community. A series of workshops focusing on water supply issues drew broad participation from local, county, and state officials. The water supply workshop presented information on a variety of strategies and funding mechanisms that local communities can use for water supply planning, conservation, and awareness. A traveling seminar, entitled "Building Livable Communities: Land Use Strategies," has been designed to provide training and information to elected and appointed local government officials. The counties that are within the JC NERR are among the fastest growing counties in New Jersey, the most densely populated state in the nation. This program focuses on growth management issues, such as strategies to protect water quality, reduce infrastructure costs, conserve open space, and retain community character.

Other technical training programs include a habitat restoration workshop series that focuses on key coastal and marine habitats within the region. Restoration is defined as applying technology to return an area from its disturbed or altered condition to its previous structure and function. This workshop series was designed to facilitate the transfer of current research to the coastal management community. As a result of these programs, coastal interest groups, management entities, and technical practitioners should be better equipped to successfully restore degraded coastal and marine habitats. JC NERR staff also delivered workshops on "smart growth," and most recently, convened a scientific and management workshop on the impacts of motorized boats on shallow water systems. The JC NERR has worked closely with the New Jersey Department of Environmental Planning, Office of Coastal Management to design and deliver Coastal Decision-Maker Workshops.

Conclusion

The Ocean Science community is stepping forward with new integrative concepts for teaching science. The JC NERR successfully capitalizes on human interest and fascination with the ocean by using the marine environment as an entry point to develop interest and capability in understanding science. With the selection of model science programs, and the development of collaborative school projects and Internet connections, the JC NERR strives to make science education more exciting and relevant to current environmental policy issues. Model programs such as MARE and the

Coastal Decision-Maker Workshop Program promote the education of the public about the ocean and its influence on the quality of their lives and the prosperity of the nation. Future efforts such as NSF's COSEE program will serve to coordinate both informal and formal Ocean Science education efforts nationally.

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